
SIGILL: COLL: HARVARD: CANTAB: NOV: ANGL: 1650.
CHRISTO ET ECCLESIAE
The Gift of
the Legislature
6 Dec. 1869.

[redacted]

MARSDEN. DEL.

Ayshire Bull,—"HONEST JOHN." Bred and owned by William Birnie, Springfield, Mass. Dark red and white; calved March, 1864; sire, "John Anderson;" dam, "Daisie 4th."

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THIRTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

MAINE BOARD OF AGRICULTURE.

1868.

AUGUSTA:
OWEN & NASH, PRINTERS TO THE STATE.
1868.

1869, Dec. 6.
Gift of
the Legislature.

BOARD OF AGRICULTURE.

SAMUEL WASSON, PRESIDENT.
RUFUS PRINCE, VICE PRESIDENT.
S. L. GOODALE, SECRETARY.

(TERM EXPIRES JANUARY, 1869.)

NAME.	COUNTY.	P. O. ADDRESS.
JAMES M. CARPENTER,	Kennebec,	Pittston.
PETER W. AYER,	Waldo,	Freedom.
WILLIAM S. BROWN,	Lincoln,	Waldoborough.
RUFUS PRINCE,	Androscoggin,	Turner.
CALVIN CHAMBERLAIN,	State Society,	Foxcroft.

(TERM EXPIRES JANUARY, 1870.)

S. F. DIKE,	Sagadahoc,	Bath.
SETH SCAMMAN,	Cumberland,	Scarborough.
SAMUEL HOLMES,	Oxford,	Peru.
ALBERT MOORE,	Somerset,	North Anson.
S. L. GOODALE,	York,	Saco.

(TERM EXPIRES JANUARY, 1871.)

SAMUEL WASSON,	Hancock,	Ellsworth.
ELIJAH B. STACKPOLE,	Penobscot,	Kenduskeag.
JERE R. NORTON,	Franklin,	Avon.
LUTHER CHAMBERLAIN,	Piscataquis,	Atkinson.
MOSES L. WILDER,	Washington,	Pembroke.
ISAAC HOBBS,	Knox,	South Hope.
J. V. PUTNAM,	Aroostook,	Houlton.

REPORT.

To the Senate and House of Representatives:

On the third Wednesday of January, 1868, the Board of Agriculture convened at the State House in Augusta, and being called to order by the Secretary, James M. Carpenter was chosen Chairman for purposes of organization.

Messrs. Wasson, Prince and Holmes were appointed a Committee on Credentials. They reported a quorum present.

Permanent organization was effected by the unanimous election of

Samuel Wasson, *President.*
Rufus Prince, *Vice President.*
Stephen L. Goodale, *Secretary.*

The following Standing Committees were announced by the Chair:

Business Committee—The Secretary, *ex officio,* C. Chamberlain, Dike and Moore.

On Elections—Messrs. Carpenter, Brown and Norton.

On Pay Roll—Messrs. L. Chamberlain, Wilder and Prince.

The Rules and Orders of last year were adopted for use until otherwise ordered.

Mr. Wasson introduced the following preamble and resolution, which was adopted:

Whereas, the potato occupies a prominent position among the staple products of Maine; and whereas, the same variety is known in different sections by different names, and also new sorts are constantly being introduced, therefore

Resolved, That the Board of Agriculture hold an exhibition at the Agricultural Room on the third Thursday of January, 1869, at which we trust all the more valuable varieties of the potato in cultivation may be exhibited for comparison, correction of names, and general instruction.

An *ad interim* paper was then read by Mr. Carpenter on mixed husbandry, which gave rise to a somewhat protracted discussion and was finally adopted, as follows:

Report on Mixed Husbandry.

To what extent should mixed husbandry be practiced? Mixed husbandry, as understood by the writer, is a system of farming by which the greatest possible variety of products are raised that may be required for the use of the farmer and his family. Hay and pasturage may form the great foundation of all. Apple orchards and other fruits, the rearing of horses, cattle, sheep, swine and poultry, the production of wheat, corn, barley, oats, potatoes and other vegetables, may be considered an illustration of the *mixed* side of the question. The opposite to this may be classed as *special* husbandry.

The advantages of the former system are that all the products that are needed for home consumption will be where they are required for use, and will not be subject to the cost of transportation. The variety of crops will enable the operator to take advantage of our short seasons for sowing and planting, so as to save time in putting his seed into the ground, and give him a better prospect of a good harvest than could reasonably be expected from the production of one article. And it will also give him the assurance of a fine basis, less subject to ups and downs by reason of fluctuating markets, as often occurs when the sale of one product has to be depended upon as a source of income.

The nation, State, community or farmer that comes the nearest to living within their own resources, will first become independent. You must sell more than you buy, or you will never get rich. One's labor requires to be made productive by intelligent application, in order to be successful.

The extent to which this shall be practiced is the main question. It will be admitted that the best judgment should be exercised in regard to it. Location as to markets, storability of product, soil and climate, should be taken carefully into the calculation. In the exercise of that judgment one would select from the products one or more, that in view of all the circumstances would be the best adapted to his location, soil and market, and bend his extra efforts to the production of those that from experience are found to be the most profitable, looking to a series of years rather than to present profit; as it will be easily seen that from this source, the surplus

production, all his means will come to meet his expenses and allow him something if possible for a rainy day.

When nearly all that is required for home consumption is raised on a farm, it will be found that a much smaller surplus will be needed to purchase articles that cannot be produced, than would be the case if only one article was depended upon to meet all demands. It should be recollected that every article consumed on the farm and not produced there must be purchased and brought home, and it must be paid for by something sold from the farm: and that will have to be transported to a market. From these facts it is evident that it would be more advantageous to produce many articles that may be required, even at a cost considerably higher than such articles are quoted at in the market; as two transportations will have to be met by the farmer. And then there is a great satisfaction in consuming one's own productions, especially of all articles of food.

It is from the small, constant, numerous springs that large rivers are formed, rather than from the rapid mountain torrent that soon finds its way to, and is lost in the sea. The great reliable strength of the immense iron bridge cables is owing to the number of separate wires with which they are constructed. It requires a very remarkable musician to play a tune on an instrument with only one string. So in all the affairs of life, especially with those who deal on a comparatively small scale, it is considered more prudent to adopt a middling course than either of the extremes. It may be said that in order to approach perfection in the production of any article or in any pursuit, one should apply himself to one thing at a time. This comes nearer to the facts in mechanical affairs than in agriculture, although to some extent it is true in both. We believe, however, that a man with a farm to cultivate and care for, with the advantages for improvement and information that exist at the present time, may be sufficiently intelligent to do more than one thing. If he has the usual variety of farm stock, he may improve it. If he has an orchard, he may improve that by keeping sheep, even if wool is dull, and both together be made profitable when one alone would result in loss. And so on through the list of products. We recommend this question to the careful consideration of the farmers of our State. It appears by the census returns of 1860 that there were in this State 55,675 farms,—1,719 of ten acres and under; 48,884 of from ten to one hundred acres; and 5,072 of over one hundred acres—about nine-tenths of the whole

being in farms of less than one hundred acres. They constitute a large proportion of the taxable property of the State. Let every one review this matter and weigh it in all its bearings. If they find themselves going in a wrong direction, one that is unprofitable, a change can be made. But it is not desirable to change often. A steady, careful, industrious line of action seldom fails of an abundant reward. Success contributes to a general satisfaction. If the farming operations in our State can be made profitable, more will be satisfied to remain and till the soil, and less go to seek their fortunes elsewhere. This is very desirable, and all classes of industry should be encouraged and fostered that one may help the other, and with their united strength build up the State.

J. M. Carpenter, *Kennebec Co.*

Mr. Holmes of Oxford, submitted a paper being a report on a topic committed to him for investigation at the previous session:

On the Comparative Profit of Cattle and Sheep Husbandry.

"Which is the more profitable, the raising of sheep or cattle?"

When I proposed this question to the Board, I had no doubt but the raising of sheep was much more profitable than that of cattle, and probably this would be the case should we have no reference to the profits of the dairy. If the farmer should calculate nothing but the amount arising from the sales of cattle, throwing out of the account the benefit or profit of the milk from his cows, which is converted into butter and cheese or consumed as food for his children and other uses in his family, and helps to raise and fatten his pork, and should set aside the advantages of the labor of his steers and oxen, and making no account of the greater quantity of manure produced by his cattle, no doubt he would find the raising of sheep more profitable than the raising of cattle. What I shall say on this subject will be mostly from my own experience during the past six or eight years.

I have kept good cows of the breeds common in my vicinity, but no fancy breeds. My sheep are of the common breed also. I have generally selected the largest and strongest sheep to keep, such as would be good breeders, having much regard to their capacity for raising lambs; for I have realized more from the sales of my lambs than I have from wool. On an average my sheep have produced four pounds per head. Some years they have averaged four and a quarter pounds.

In comparing the profits of raising cattle and sheep, I shall estimate the keeping of eight sheep to be equal to the keeping of one cow; or the keeping of forty sheep as equal to the keeping of five cows. We will now call the expense in stocking a farm either with cows or sheep equal, that is, that five cows will cost the same as forty sheep. Forty dollars for a good cow, in the fall of the year, would be as much as the average price has been for the last eight years; and five dollars per head would buy the best of our common sheep in the same years. We know this comparison of prices will not exactly suit the present state of things, the price of sheep having diminished beyond that of cattle, but I propose to answer this question agreeably to the state of affairs as they existed when the inquiry was made, presuming they may compare for the next decade about the same as in that which has passed. We will next consider the profits of forty sheep. We will calculate the sheep to bring up one good lamb each, which will sell in the fall for three dollars, amounting to one hundred and twenty dollars; and that the sheep will average four pounds of wool per head, giving a yield of one hundred and sixty pounds of wool. I have sold my wool for the last eight years at the average price of fifty-six and one-fourth cents per pound. At this price the wool will bring ninety dollars, which makes two hundred and ten dollars income from the forty sheep. The sheep must be well kept and cared for to produce the above result, and it must be admitted that I have allowed for more than ordinary success in raising lambs.

We will now see what will be the income of five cows. It has been ascertained by actual experiment that one gallon of milk will make a pound of cheese. I think that calculating two and a half gallons of milk per day from each cow for four months, reckoning from the middle of May to the middle of September, would not be too high an estimate. This would give fifteen hundred gallons of milk, which will make fifteen hundred pounds of cheese. I think the average price of good cheese, for the last eight years, has been about sixteen and two-thirds cents per pound. At this price fifteen hundred pounds of cheese would bring two hundred and fifty dollars One gallon and a half of milk per day for each cow, would not, I think, be a high estimate, from the middle of September to the middle of December, by which we get from the five cows six hundred and seventy-five gallons. Allowing three gallons of milk to make a pound of butter, we get two hundred and twenty-five pounds of butter, after suspending cheese-making. I believe the

average price of good butter for the last eight years has been about thirty cents per pound. At this price we get sixty-seven dollars and fifty cents for the butter. Now we will suppose the cows to have a calf each in the month of March, and we will keep them until the middle of May, when they will be from six to eight weeks old, and will sell as per average of past prices for eight dollars each, making forty dollars for the calves. We now have the following results as the gross income of the five cows: Calves, $40; cheese, $250; butter, $67.50—total income, $357.50. We made the income of the sheep, $210, showing a difference in favor of the cows of $147.50.

It may be said that it requires much more labor to take care of the cows, and to manufacture the cheese and butter, than it does to take care of the sheep. This I admit; but sheep need a good deal of care and attention, especially in the spring of the year when they are bringing their lambs, and it requires some labor to wash and shear them, besides more care and pains in fencing, as a general thing, than for cows. From the cows while manufacturing the butter and cheese, we get sour milk and whey, which will do much towards compensating for the labor of attending the dairy. The whey and skim milk will aid much in keeping and fattening hogs, and the hogs will make much valuable manure if properly attended to, by being well supplied with muck, loam, weeds, leaves, &c., so that with the cows and hogs we have a greater quantity of manure than we can obtain from the sheep; enough perhaps, with the pork from the hogs, to fully compensate for the extra labor of the dairy. It will be seen that by keeping cows we can obtain more manure to enrich our soil, we can raise more corn, potatoes and hay, &c., and keep our farms in a higher state of cultivation.

But we will say nothing of the profits of pork and manure as connected with the dairy, and confine ourselves to the more immediate and direct profit of the two species of stock under consideration. We will suppose it would take a woman one-half of the time for twenty-eight weeks to manufacture and take care of the butter and cheese, and that her labor and board would cost six dollars a week; half this expense would be three dollars a week for twenty-eight weeks, which would be eighty-four dollars. We take this from our former balance of one hundred and forty-seven dollars and fifty cents, and there is still left in favor of cows, a balance of sixty-three dollars and fifty cents. Many farmers believe that a farm stocked wholly with sheep will deteriorate or "run out" sooner

than if stocked with cattle. This idea I believe correct. It is certain that we obtain much less manure from them and that they crop the feed much closer than cattle, especially on the high land where the feed is the sweetest, and will not feed on low, swampy land, if they can find green roots of grass on high land.

As to the raising of cattle—steers or heifers, to sell while young for beef or other purposes, I am of the opinion that though the profit may preponderate in favor of sheep, the advantage is not so great as many people suppose, when taking into consideration the extra labor of caring for and attending to the sheep, with the benefit resulting to the farm by keeping cattle instead. The labor of the ox is almost indispensable, and with many farmers the steer, after he becomes two years old, nearly or quite pays for his keeping if properly fed and well treated, without materially injuring his growth. Many do not fully appreciate the useful labor of the ox, and do not sufficiently consider that much of the income of the farm, and even the means to rear and provide for their sheep, is due to the usefulness of this valuable animal, and should be set down as part of the profit of raising him.

I believe the reason why sheep are considered by many the more profitable stock to keep, is because the income of the flock comes in at stated seasons in whole sums, or solid parcels, while that of cows is frittered away in family use, and the ox is only credited for what the butcher may pay for him after his service is rendered. It is the opinion of many of the farmers of Oxford County, that it would be well for them to give more attention to dairy products and the raising of cattle, and less to the raising of sheep, especially to fine wooled sheep, as it is thought we shall be likely to have more competition from the Western States in wool than in dairy products, and in this opinion, after giving the subject some thought and attention, I am led to coincide, and believe that the raising of cattle is more profitable than the raising of sheep.

SAMUEL HOLMES, *Oxford Co.*

Mr. Moore next presented a report on the topic committed to him at the last session, as follows:

Sheep Husbandry in Somerset County.

In treating upon this subject, it is assumed, first, that the best interests of the farmers of Maine demand a system of mixed husbandry—not only of the immediate productions of the soil, but of

the live stock raised upon the farm. And second, the consumption, on the farm, of all the crops produced. Any other system would fail of success, under the exhaustive process of taking from, without replenishing the fertility of the soil, except near good markets, where products could be exchanged for fertilizers.

Starting from these premises, the advantages of sheep raising, in connection with other agricultural pursuits, would seem to be the practical question to solve to be of value to the farmers of Maine. Not whether wool and mutton can be produced in Maine cheaper than in Ohio, Texas or California, but does it pay to raise sheep in Maine? for if this point is negatived, further discussion is useless and better be abandoned. On this point, a late number of the *Wool Grower* well says, that "everywhere and anywhere the sheep will live and thrive, and with proper care, pay more for the labor and capital invested, than any other animal or any other system of farming. It is one of the most useful and economical modes which have been given us to convert the vegetation of the farm to money. There is no animal in which there is so little waste or so little loss. For at least seven years of its life, it will give an annual fleece of the value of the carcass, and the yearly increase will be nearly or quite equal to the cost of keeping." The farmers of Maine are coming to appreciate the advantages of wool-growing, so tersely stated in this extract, and we find the flocks increasing on the thousand hills of our rough and mountainous State, from 374,000 in 1860, to 1,041,724 in 1866, as reported in the February number of the report of the Commissioner of agriculture—an increase of 667,724 in six years, and an annual increase of 111,287.

In my county, the county of Somerset, the statistics for the year 1862, show 81,599 sheep, and 1863, 93,119. I have been able to find no county statistics reported since 1863; but taking the statistics of the town of Anson, to which alone I have had access, I find it had in 1862, 8,616 sheep; in 1863, 11,944; 1865, 13,098; 1866, 13,199; 1867, 13,592—an increase in five years of 4,976, average annual increase, 995. The same ratio of increase would give Somerset county in 1867, 128,725, an increase in five years of 47,126, an average annual increase of 9,425—equal now to about one-eight of the whole State. These evidences of the thrift and prosperity of this branch of agriculture seem to furnish an answer to the question, does sheep husbandry pay? But it may be asked, will the figures, which it is said never lie, show a corresponding result? The following statements, of some of the most intelligent

and practical sheep-growers in Somerset county, in answer to questions propounded, are to this point:

W. W. Pease of Anson, states: "My sheep number about three hundred; are Spanish Merino, pure and grade; use the best buck I can obtain; lambs come in April and May; flock will produce one-third its number of lambs, besides loss and waste; one hundred sheep will consume eighteen or twenty tons of hay or its equivalent in other feed—my sheep averaged the last year, six pounds of wool a head; think that the flocks through the town will average five pounds per head; one hundred sheep will consume about the same amount of hay as ten cows—average time of feeding, five months."

Major Samuel W. Tinkham of Anson, states: "My flock numbers two hundred and twenty, consisting of grade and pure-blood Merinos; breed from pure American Merino bucks, always obtaining the best I can; my lambs are dropped in May, after the sheep are put to grass, I therefore feed no grain; flock averages six pounds per head; average price of sheep now about $5, though they have been much higher; lambs average $5; twenty tons of hay to one hundred sheep is a fair estimate of feed; consider that ten cows will consume the same amount of hay as one hundred sheep; sold my wool in 1863 for 75 cents; in 1864, for $1; 1865, for 74 cents; 1866, for 70 cents; in 1867, for 46 cents per pound; I think as long as the present tariff exists, wool will bring at least 50 cents per pound. The following is about an average of expenditures and receipts on my flock, per hundred, for the past five years":

EXPENDITURES.

100 Sheep, valued at $5 each,	$500 00	
20 tons of Hay, average price $12,	240 00	
Pasturing,	40 00	
Washing and Shearing,	15 00	
		$795 00

RECEIPTS.

600 lbs. of Wool, average 70 cents per lb.,	$420 00	
40 Lambs, more than waste,	200 00	
Flock worth now,	500 00	
		$1,120 00
Profit,		$325 00

Q. P. Wood of Anson, says: "As I have had the benefit of more than thirty years experience in sheep husbandry, I think I

can answer the questions proposed with considerably accuracy. One hundred sheep, average live weight ninety pounds, require four tons of hay per month, or twenty tons in five months, which is the usual time for feeding sheep in this locality. Twelve sheep require about the same as a cow. Good English hay placed on clean snow when practicable, with pure water, is the best feed imaginable for sheep in winter. If hay is poor, grain should be fed in sufficient quantity to keep alive the ambition of the sheep—say one gill of corn or beans, or pint of oats per head, per day. I feed as above in spring to sheep while they are in a transition state between hay and grass. Sheep require food nearly in proportion to their weight. I will just mention that I never fed hay under cover that was so good that they did not make orts, or so poor as to cause them to leave it, when placed on snow in open air. I select about one hundred of my best ewes, between the ages of three and five years, from which I raise about eighty-five lambs annually. Never sold a sheep under three years old, sell annually off the other end of the flock. Average price for the last five years preceding 1867, about $6. At shearing, I find quite a large proportion of my flock young and smart, yielding the last five years hardly four pounds, the average of the finest quality Spanish Merino wool, which sells at the top of the market. Sold in 1866 for 67 cents; clip of 1867 yet unsold."

Jabez D. Hill, Esq., of Moscow, furnishes the following: "For several years past I have kept from two hundred to two hundred and fifty sheep. They are now grade Merino—not equal to the crack flocks of Vermont, but very much better than the flock with which I began the business, some half a dozen years ago. I consider it a matter of the first importance in sheep husbandry, that you have a good pasture, so that the flock may come to the barn in the fall, fat. Fat, in the latitude of Somerset county, is the great panacea for warding off sheep disease. A fat sheep, not extremely old, with ordinary treatment, may be warranted to go through a northern winter safely.

And here let me remark, that what follows regarding sheep has reference to flocks where two or three hundred are kept, rather than to those of half a dozen, kept just for a little 'stocking yarn.' A few sheep on a farm will be pretty sure to get a full share of the green herbage and of the dried fodder, and look well. They can run out in the fall till snow comes, and cropping closer than cattle,

will find food enough. But with large flocks the case is different. As freezing weather approaches, it is generally found that they have stripped the fields bare, and it will not do to take it for granted that because the ground is uncovered with snow, the sheep are 'doing well enough.' When the ground freezes, if not before, a large flock must be fed partly or wholly at the barn—wholly is the best, unless you are willing to diminish next year's hay crop, by letting the sheep nibble up the grass roots. I put mine in the basement of the barn and in sheds, with a small yard which has running water in one corner, to which they have free access during the day. The lambs are separated from the rest of the flock; old, feeble or otherwise undesirable sheep are sold or killed—we get a pelt if nothing more. We feed four times a day—two feeds for breakfast and two for supper—hay put in the ordinary boxes; don't feed before light nor after dark. Feed twice for breakfast, &c., because the sheep can be made to eat up the fodder with less waste. Make them eat up clean; or if the fodder is too poor for that, clean out the orts before feeding again. When feeding time arrives they are all driven into the yard, and there kept till the boxes or cribs are filled. This passes each animal under your eye frequently, and I believe is also beneficial to the animal as exercise. I have generally fed a little grain—say a gill of oats daily per head—but for two seasons have given the flock one foddering of oats in the straw, daily; like the plan. In this region, large flocks have to be fed twenty-six weeks, and one hundred sheep fed wholly on hay, will eat one ton per week. The present season, began to feed Nov. 5th. Calculate not to have the feeding boxes more than sixteen inches wide, so that sheep may not be induced to chafe off the wool by reaching too far for fodder. According to my observation, sheep want but little salt comparatively, while living on dry food. I keep a box containing a mixture of ashes and salt in the pen.

We lead the bucks into the pen in the morning, and when one has served a sheep once, she is spotted with red paint on the back, and he is tied up for fifty or sixty minutes, and then allowed to serve another ewe. Towards night, if the ewes are coming forward freely, he is allowed to serve one, sometimes two more. The other bucks are managed in a similar manner. Give old bucks two quarts of oats daily, with hay and water, occasionally a mess of potatoes. By turning off the poorest annually,

and keeping the best lambs, there is a marked improvement in the flock.

I choose to have the lambs dropped after the grass begins to start; but as I cannot have them all at once, I begin a little before and continue till the 5th or 10th of June. By the custom of the country, am obliged to wash the sheep in running water about the first of June; let them run a week, and then shear.

Previous to turning the sheep to grass in the spring, we 'tag' them—that is we clip off all the wool about the tail and haunches liable to be smeared by the scouring of the animal when first turned to grass. If we find in any case the wool is growing loose on the belly, that is sheared off also. The wethers in addition, have a small portion sheared around the opening of the sheath. A man will 'tag' fifty to seventy-five in a day, the last of April. These taggings are washed, and a small handful tied up with each fleece when put for market. Can shear a grade Merino sheep in about sixty minutes—don't hire many men who will do much better than that, unless they make poorer work than I want done. I want all the sheep's skin left on, and but very little of the wool. This I know will sound small beside the feats of the Buenos Ayres damsels, who, Mr. Carrow informs us, shear from eighty to one hundred each per day. But then, a fourth or a half pound of wool is of but little consequence—won't pay for close shearing—in a country where a pound can be bought for ten or twelve cents. In shearing, I seat the sheep upon her haunches, and holding the upper part of the body between my knees, take hold of the head and shear from the face all around the neck, down to the fore shoulders. This neck fleece is then laid aside; then placing the sheep on her back I stand over her, and taking a leg in one hand, and my foot placed on her neck with sufficient force to keep her from turning over, each leg in succession is sheared up to the body. Then kneeling over the sheep, I shear the belly, commencing at the breast bone and clipping along the centre to the bag. The sheep is then laid on the table and one side sheared round to the back bone, when that portion of the fleece is torn off and laid away. Then the animal is turned over, and the other side sheared. This method was taught me by an old Englishman, brought up near the Romney marshes, who learned the trade of shearing 'at home'—except he dispensed with the table altogether. I have tried other methods, but think I can keep the best portions

of the fleece unbroken by the one described, better than by any other.

When the lambs are a few days old, they are marked. At shearing time they are castrated. By this time, thinking I have let blood enough, I frequently let 'docking' go till the next spring, and then tie the stump with a waxed thread. Immediately after the sheep are sheared, the lambs are dipped in a decoction of tobacco, or 'Indian poke,' to kill the ticks. The sheep don't need it—they are clipped close enough to destroy or clear out the vermin. A bushel and a half of 'poke' root boiled in a barrel of water till you get its strength, will answer for fifty lambs. Put the wash in a barrel or large tub; place a piece of wide board so that one end shall rest on an elevation a few inches higher than the tub, and the other on the end of the open tub itself. Take the lamb by the fore legs from the assistant who catches him, and dip him in the moderately warm poke juice, taking care while you settle him in the liquid with one hand, that the other is grasped around his mouth, so that the nose and eyes, may not be immersed. As soon as his wool becomes well saturated, lift him out and place him on the sloping board above the edge of the tub, where he may drain a little, then dismiss him for another. After this operation, the noses of the whole flock are tarred to keep off the fly which produces the grub in the head. This tarring the nose had better be repeated in three or four weeks. When the sheep are turned to pasture, three or four bells to the hundred are hung to their necks; the noise from which serves to scare away many enemies of the sheep-fold. The flock is sheltered as much as possible from the cold rains, spring and fall. Give three quarts of salt to one hundred, once a fortnight in summer. The lambs are weaned about the 1st of September, by putting in a good grass plot, out of hearing of the sheep.

With regard to curing diseases, I have made but little headway. Sometimes the animals I have experimented with have died, sometimes they have in consequence of, or in spite of my treatment, recovered. However, I am satisfied that my attainments in this direction will not warrant me a diploma. The sheep business is, as you are well aware, in a very depressed condition. The low price of wool has induced many, perhaps ruinously, to get rid of their flocks. In large portions of Somerset County, hay and pasturage are the main resources of the farmer; and instead of being sold must be used up on the land, in order to keep up its

fertility. Even laying aside the question of fertility, with our lack of home markets and facilities for reaching more distant ones, we should still, in the casé of so bulky an article as forage, be compelled to use it up at home. Therefore, the only way to decide whether wool growing is a remunerative business, is to compare it with the raising of cattle and horses. It is true the prices of cattle have not dropped so ruinously as sheep, and apparently promise a better margin. But in view of the value of sheep as renovators and fertilizers of our mountain pastures, it may be doubted whether many have not moved with a wasteful precipitancy in decimating their flocks. Wool must be had as long as we live in a freezing climate; and probably, taking a series of years into the account, will pay as well as the rearing of cattle. There is no doubt but that for the last fifteen or twenty years, sheep husbandry, when conducted by men of intelligence, energy and ordinary tact, has been as remunerative as any other branch of farming; and I believe that a majority of the old 'standards'—not the 'shifty' ones, who flocked into the business because wool had gone up to war prices, measured in a depleted currency—who have followed their flocks for years, notwithstanding the portentous clouds now seen in the financial sky, still look upon it as holding a similar promise."

Hon. William R. Flint of Anson, furnishes me with the following statement:

"The sales are mostly from records, but numbers of sheep are sometimes estimated, especially the distinction between sheep and lambs when sold.

Years.	No. Sheep.	Average per head.	No. pounds.	Price per pound.	Amount.
1863, . .	400	5 lb. 4 oz.	2100	50 cents.	$1,050 00
1864, . .	400	5 6½	2163	82	1,773 66
1865, . .	390	5 3¾	2100	$1.00	2,100 00
1866, . .	416	5 4½	2184	61 cents.	1,332 24
1867, . .	400	5 7¼	2180	48	1,046 40
					$7,302 30

Years.	Lambs raised.	Lambs sold.	Price of Lambs.	Sheep sold.	Price of Sheep.	Amount.
1863, . .	140	40	$5 00	80	$6 00	$480 00
1864, . .	136	25	4 00	75	6 00	450 00
1865, . .	146	33	3 50	75	5 00	375 00
1866, . .	133	56	3 00	85	4 00	340 00
1867, . .	136	40	2 50	70	3 50	245 00
						$1,890 00

The sales of sheep and lambs have generally been of inferior sorts.

DR.

Estimate of flock of 100 sheep to keep the flock good in numbers and years, estimated to cost $4 each,	$400 00	
17 tons hay, $10 per ton,	170 00	
Pasturage, 50 cents each,	50 00	
Washing and Shearing, 12 ½ cents each,	12 50	
Allowing 5 per cent. for deaths, accidents, &c.,	20 00	
		$652 00

CR.

100 Fleeces, 5 lbs. each, 70 cents per lb.,	$350 00	
33 Lambs, 15 to sell at $4 each,	60 00	
18 Sheep, $4 each,	72 00	
95 Sheep, value of the flock at $4 each,	380 00	
		$862 00
Profits,		$210 50

Statements received from other prominent sheep-growers show so nearly the same results, that they need not be repeated. The average estimate of these statements show about the following results:

EXPENSES.

Cost of 100 Sheep, $5 each,	$500 00	
20 tons of hay for feed,	240 00	
Pasturing,	40 00	
Washing and Shearing,	15 00	
		$795 00

RECEIPTS.

500 lbs. Wool, average 50 cents per lb.,	$250 00	
35 Lambs more than waste,	175 00	
Value of flock at end of year,	500 00	
		$925 00
Profit,		$130 00

Another source of profit not generally taken into the account, is the value of the sheep as a renovater of exhausted or partially exhausted lands. He is said to be a public benefactor, who makes two spears of grass grow where only one grew before. We do even more when we stock our worn-out pastures with sheep. The sheep indiscriminately crops every weed, shrub or bush—save the Canada thistle, which is rather promoted than retarded in the sheep pasture—these wild bushes soon give place to clover and the finer grasses.

To the question—"What is the best method of reclaiming ex-

hausted lands?" We have in the Agricultural Report of 1857, the answers of five correspondents, all to the same import, which may be summed up in the comprehensive reply of one of them—"turn it out to sheep." On this subject one writer says: "Experience shows that sheep walks instead of becoming exhausted, uniformly grow better and more productive; and one of the most effectual means of destroying the bushes and mosses, and bringing back the sweet grasses to an exhausted pasture, is to turn upon it a flock of sheep."

Another writes: "I have seen pastures that had become almost worthless, but now green and smiling as a lawn, with every inch among the rocks covered with the richest pasture grasses, and not a blackberry vine, wild rose bush, mullen, or other useless plant in sight—all from feeding sheep upon it."

As early as 1850, in the infancy of sheep husbandry in Maine, Hon. Wm. R. Flint of Anson, as reported in the Patent Office Report of 1851, wrote: "Sheep are peculiarly adapted by their habits, to render important services as pioneers to the plow, reducing, in a few seasons, lands that have been mortgaged to weeds and briars, to arable fields, and while doing so, thrive so that their sides will stick out with fatness; or will scale the rough hill-sides, and glean food where the implements of husbandry are useless. They invariably leave a pasture better for having been kept in it. An old sheep pasture that can be plowed may be looked upon as but one step from a well-filled granary."

There seems but one opinion among farmers on this point. All agree that sheep are no mean renovaters of worn-out grounds, and moreover it is believed that a pasture full stocked with cows or other neat cattle, will carry the same number of sheep without detriment to either, and with benefit to the pasture. Sheep-raising for mutton is so little known in the agricultural districts of Maine, that no data exists on which to estimate the profit if any; but our reports all agree that in the vicinity of a good market, mutton-raising pays well. The *United States Economist* says: "In Illinois and other parts of the West, where corn is raised in such quantities that it is at times used for fuel, the Leicester and Cotswold sheep would pay a large profit to the grower, if raised for mutton alone, leaving out of the account the value of the fleece; but the largest profit in growing of sheep in our country, is realised on the clip. It is estimated in all sheep-growing countries that the increase of the flock will fully offset the cost of

keeping, so that the clip is clear profit." In Maine, mutton is coming into more general use, and will, as it ought, become *the* meat for family use, at no distant day. It is the most wholesome, nutritious, and cheapest of meats.

The Merino seems to be accepted as the best adapted to wool-growing, while it is conceded that the coarser wool breeds are preferable for mutton. The Genesee *Farmer* speaking of the different breeds, says: "The advantages of the Merino are; 1st, they produce more wool for the food consumed; and 2d, their wool usually commands a much higher price. The advantages of the long-wooled sheep are: 1st, they afford more mutton for the food consumed; and 2d, the mutton usually brings a much higher price. Under ordinary circumstances it is not easy to determine which of these two classes of sheep are, on the whole, most profitable. It depends much on the character of the soil, on the location, the system of agriculture, the proximity to market, and on the taste of the breeder. Other things being equal, sheep undoubtedly consume food in proportion to their live weight; and as long-wooled sheep are nearly double the size of Merinos, and as they do not yield double the amount of wool, it follows that, leaving the mutton out of the question, a pound of wool cannot be produced from the long-wooled sheep as cheaply as from the Merino." There can be no doubt of the truth of this proposition, if it is a fact—which we think will not be denied—that fine-wooled sheep, in proportion to their live weight, produce more wool than the large, long-wooled mutton sheep.

Hon. Wm. R. Flint, when a member of this Board, made a report on sheep, in which he says: "From numerous experiments for a course of years, as well as from more recent inquiries and investigations, they have come to the conclusion that for all purposes of sheep culture and wool growing, the Spanish Merino of the early importations—improved and kept free from all crosses of the Natives, Dishleys, South Downs, Cotswold, French or anything else—possess the most desirable qualities of any sheep in this country. Their herding habits are so fixed that much larger flocks may be kept together than of any other sheep, without degenerating; requiring much less food for summer or winter, and being easily secured in pastures or enclosures. Whatever qualities these sheep possessed when first imported, they have now become thoroughly acclimated; being improved in constitution, in form and size, as well as in weight and fineness of their

fleeces. Their wool being more closely packed over the whole body, and furnished with abundant oily secretions, the animal is thoroughly protected from the sudden changes of the weather in our climate, and hence are more healthy."

Mr. Flint also writes to the Commissioner of Patents, December, 1850, that "if the raising of wool be paramount, the Merino is superior to all others introduced among us. They will grow more wool from the same weight of sheep, will eat a greater variety of vegetables, are more peaceable, therefore requiring less watching to keep them within enclosures; and taking all the items of expense and care into consideration, will produce wool as cheap per pound as any of the coarser breeds."

Mr. H. S. Randall of New York, says in a communication to the Commissioner of Patents, that "for wool-growing purposes, there is but one breed in the world entitled to a moment's consideration—this is the Merino."

The care and management of sheep requires special attention; but the practice of sheep-growers is so varied, and in the opinion of each, his own the best way, than any attempt to lay down any fixed rule, would be only an expose of one's own method. There are, however, some general rules that may be considered essential by all—regular feed and plenty of it, warm shelter in storms and cold weather; well ventilated sheep barns or sheds with yards opening to the South, if possible; room for free exercise; plenty of running water and an occasional feed of roots are among the essentials. The matter of feeding differs among farmers—some feeding two, some three, and some four times a day, as by the statements noted above.

A correspondent of the *Maine Farmer*, who signs, "W," gives his method as follows; "Three fodderings a day for sheep is thought to be enough, and some feed only twice. Their lightest meal should be in the morning, and heaviest one at night, when every sheep should be well filled out. Don't feed too early in the morning nor too late at night—they want daylight to eat by."

A Vermont sheep-grower writes to the Genesee *Farmer*: "Some farmers appear to think that a flock of sheep will do better if foddered three times a day. Sheep fed three times a day are not as hearty as if fed only twice; besides they waste a great deal of hay. Sheep should not be disturbed until sunrise on a cold frosty morning, and then fed some good hay and a little grain. Give them all the water they will drink during the day, and feed

again at three o'clock in the afternoon. By the time it is dark, they have eaten and drank enough, and are ready to lie down and rest until the next morning."

The feeding crib or sheep-rack in common use in Somerset County, is made by setting uprights of common joist, three feet long, at each corner, giving the desired length, and three feet apart for the width; and if over twelve feet long, one upright between on each side. Nail a six-inch board lengthwise and across the ends of these, the lower edge eight or twelve inches from the lower end of the uprights. Make a bottom for the crib even with the lower edge of this board, four or five inches crowning in the centre; to the top of the uprights nail another six-inch board lengthwise, and across one end if to set against the feeding floor: if not, across both ends. From a line on the bottom nine inches from the outside, nail upright strips seven inches wide and seven inches apart to the top boards on each side and end, and you have a sheep-rack of any designed length, a foot and a half wide on the bottom, and three feet wide at the top, with seven-inch feeding space and seven inches between, and a box or trough outside the upright strips to catch the chaff and seed, and to feed grain and roots.

But plenty of feed is the secret of success after all. Dr. Dadd, in the *Prairie Farmer* says: "The only way to prevent grub in the head of sheep is to put plenty of "grub" into the stomach of the animal; and it is a well-known fact that sheep properly attended to, well fed and housed, are never troubled with the parasite known as the grub." Almost the only sheep disease now known in northern Maine, is the foot-rot. At first this created quite an excitement, and produced great alarm among our flock-masters; but they have got bravely over the panic and now think themselves masters of the situation. After trial of nearly all the remedies recommended in the books, they use simply a solution of spirits turpentine and blue vitrol. As soon as the sheep is discovered to favor the foot, draw a small cord briskly between the hoofs a few times, apply the wash and the thing is done—so say our sheep farmers.

Ventilation is indispensable in the sheep barn. No flock can escape disease and thrive, cooped up in a 7x9 close pen. Exercise is equally indispensable to the health and thrift of the sheep. They are naturally a roaming animal; in native sheep countries, driven over mountains and through valley and plain to grub their

subsistence. Want of this or of some kind of exercise, is frequently the cause of diseased flocks. Give the sheep frequent exercise, good clean, airy shelter, plenty of feed and pure running water, and they will look sleek and fat, and pay well for all these.

But the price of wool has ruled so low, and the market so depressed the past year, that there is a strong disposition among farmers to "sell out." Is this good policy? We think not. We believe a comparison, even now, with the price of the products of the diary, will show that the price of wool is as well sustained as these. Let the husbandman bear a steady hand in this as in all other husbandry, and he will ultimately be crowned with success.

ALBERT MOORE, *Somerset Co.*

Mr. Dike of Sagadahoc, presented an *ad interim* report on Bee Culture, which was adopted without dissent—as follows:

Bee Culture.

The honey bee has been known from remote antiquity. It is several times mentioned in the books of the Old Testament. Herodotus mentions the bee. Cicero and Pliny refer to one philosopher who devoted sixty years to the study of the bee. A large number of books have been written to promote the knowledge of the bee, and increase its usefulness to men. Its instincts, its industry and its sweet products, have engaged for it universal attention. The naturalist, the agriculturist and the politician, have been earnest students of its mode of life and habits. The ancient Essenes, a sect of the Jews, the monks of that age of the world, who sought a quiet retreat from the corruptions and conflicts of the world in the solitudes of the western side of the Holy Land, occupied a portion of their time in the delightful employment of cultivating the honey bee. And Virgil devotes a portion of that poem which is the most finished of all his works, the Georgics, to the discussion of the subject of Bee Culture. He shows what place on the farm is most proper for the bee hive, when they gather their honey, how to call them home when they swarm, describes their battles, and their politic administration of affairs, and at last lays down the ancient method of replacing them when the race is destroyed or lost. This account of the generation of bees, is of course exploded in modern discoveries; but it was then the common opinion of learned men—Aristotle and Pliny both refer to it.

What an attractive creature the bee has always been considered. The sweet product of its industry has been sought for and used among all the most cultivated nations. "What is sweeter than honey?" And in Divine Prophecy it is said of Him who was to come into the world for its redemption and salvation, that "butter and honey shall he eat." And when a blessed state of mankind is foretold, it is described under the symbol of "a land flowing with milk and honey." And what a tiny insect it is that collects and stores the sweet honey; and how many practical lessons this little insect will teach us, if we are humble and wise enough to learn them. They live in societies as man does. And what a perfect government is theirs. It is purely a government of love and usefulness. The queen* is the mother of all her people, and her life is devoted to their services; and they show to her a correspondent regard and respect. If the queen be destroyed, and the workers have no prospect of obtaining another, they become inactive and lose their instincts. She appears to be the very soul of all their actions, and the centre of their instincts. When deprived of her, or of the means of replacing her, they lose their activity and pursue no longer their daily labors. In vain the flowers tempt them with their nectar and ambrosial dust; they collect neither, elaborate no wax, build no cells—indeed would soon perish, were not the means of restoring their monarch put within their reach.

The bee is the pattern of diligence. No human society on earth can be found more industrious, than that little organized society in every healthy hive. And then the instinct which guides them—what a wonderful power! a power bespeaking the nearness and constant presence of a power near and over us all. What skill it gives them in the construction of their cells. As these are formed of wax, not easily produced, it is important that as little as possible of such a precious material should be used. So the bees in making their cells, solve the difficult geometrical problem of building cells to use the least quantity of wax, and of a form occupying the least possible space. And every part of the problem is practically solved. If the cells had been cylindrical, a form seemingly so well adapted to the shape of the bee, they would not have economically used the space. If they were square or triangular, a greater quantity of wax would be needed to make

*The queen was anciently called king, and was supposed to be of the masculine gender. Virgil speaks of the *kings* of colonies of bees.

them. Both of these difficulties are obviated by adopting the form of the hexagon, which is admirably suited to the shape of the insect, and economy of shape and material. It is asked, whence such an instinct, and how they come to have it? I answer, it flows unto them from above; and the activity of that affection, the love of procreating their race, incites in them the activity of their instincts. Their instincts are, in fact, the development of their affection and the means of its accomplishment. We see from the loss of the queen, the source of their instinct while she is with them. The affection of producing their young and providing for them, animates and gives them their instincts to carry it out. They do not, like man, exercise a choice of means, and debate between the best and next best means, for they see only the best. They possess therefore in themselves, resources suited to changes of circumstances; and are thus often led to act as if they had the power of reasoning, but it is only instinct.

A life time may be spent in investigating the mysteries which are hidden in the bee-hive—in studying their marvellous instincts, and the wonderful life they live, and then many of the secrets would still lie undiscovered. We have just above alluded to the wonderful mathematical problem which they solve; but the changes which the honey undergoes is a matter of as great interest to the chemist. Fresh honey is a clear yellow syrup, without a trace of solid sugar; but after it is strained and exposed to the atmosphere, it gradually begins to crystalize—or candies, as people say—and finally becomes a solid lump of sugar. Now it has been lately discovered that this change is due to the action of the sunlight. The same agent which alters the molecular arrangement of the iodide of silver on the excited collodion plate, and determines the formation of crystals of camphor and iodine in a bottle, causes the syrupy honey to assume a crystaline form. M. Scheibler enclosed honey in stoppered flasks, some of which he kept in perfect darkness, while others were exposed to the light. The invariable result has been that the portions exposed to the light rapidly crystalized, while those kept in the dark remained perfectly liquid. Now the bees have to obviate this difficulty, the effect of sunlight on their honey, otherwise it will soon become ruined for their own use or that of their young. The very existence of their young depends on the liquidity of the honey presented to them.* To obviate this difficulty, they work in their

*Honey was anciently called *ærial*, being supposed by Aristotle and others of the ancients, to come from the dews engendered in the air. Hence the term *honey dew*.

hives in perfect darkness. They are obliged to do so. If light were allowed access, the honey would gradually acquire more or less solid consistency, seal up the cells, and in all probability prove fatal to all the inmates of the hive *. So their discoveries in chemistry are equal to those in mathematics. In both, they are guided by the same power from above.

The question must by this time, be forcing itself on our minds, for what is such a wonderful little insect made in our world? Surely it was made to be useful—like all the things which God has made, each one has its use. If we go out into the fields and pastures on a bright summer day, when Nature is clothed in all her beauty, and the flowers are expanding and filling the air with their fragrance, and examine minutely enough these flowers, we shall find a set of vessels have been pouring into the cup or nectary of each one of the millions of flowers which deck the earth, a minute portion of honey. The bee is made to perform the use of collecting this honey and depositing it in the hive, where a portion of it can be taken for the service of men. The honey is made in such minute quantities, that it will hardly seem at first as if it was worth while to collect it. Why not let it spend all its fragrance on the air? Not so thought our good Father above, and so he made the bee to collect it; for he suffers nothing to be wasted in all his vast domain. In this way the honey can be converted into use, and millions on millions of these tiny little insects can enjoy the pleasure and happiness of a brief, but most industrious life. But it was foreseen by the all-wise Father, that the bee could be made to subserve another use in the animal economy while it is on its daily excursions, collecting honey.—Vegetable Physiology teaches us that the stamens and pistils of flowers answer to the different organs of the two sexes in animals. The pistil is connected with the ovaries, the stamens furnish the pollen, which must come in contact with the pistil—in other words it must be impregnated from the dust of the stamens, or no fruit will be produced. A field of wheat produces long, slender stalks, which bend to the influence of the breeze, and one ear shakes its pollen on a neighboring one at some distance. So in a field of corn, the upright stalk bearing the stamens, some feet above the pistils, drops the pollen on the ears below. And the winds come and waft the abundant pollen rods distant from the producing

* See "Chronicle of Optics," in the Quarterly Journal of Science, for the above statement of the reason why bees work in the dark.

stalk, and fertilizes the distant ear, as is proved from the different varieties mixing at so great distances. Now the bees are not wanted in such cases as these. Other agencies can do the work. But the case is different in multitudes of small flowers and vines which trail along the earth. The winds cannot be made to do this work here; but the little bees can do it, in their constant visits, as well as not. So their little bodies are made in such a rough and hairy manner, that when they enter the flower in quest of honey, they cannot help shaking off and carrying away more or less of the pollen, and leaving a portion on the pistil of some distant flower. They want themselves, both the honey and pollen. Each flower secretes but little, just enough for the attraction of the bee. Nothing like a full load is obtained from one flower; were it so, the end would not be answered. A hundred or more flowers are visited in one excursion. The pollen of the first flower visited will fertilize many, previous to the return of the bee to the hive—thus the field of buckwheat is kept in health and vigor by the visits of the bee, and breeding in and in, the farmer's dread is totally prevented. And so needful is the bee among our vines, that it has been inferred by many that if it were not for these visits, the uncertainty of a crop, from non-fertilization, would render the cultivation of them useless.

Have we ever duly considered how useful to us all is the bee, in addition to the value and profit of its products in the hive? I have no doubt that if bee culture were much more general in our State than it is at present, it would add much to our knowledge, pleasure and profit. Among all the stock which we keep on our farms, the honey bee can be kept in the cheapest manner, and yields the most profit in proportion to the expenses of keeping. She works for nothing, and finds herself. All she requires is a proper hive, where she may deposit her precious treasure, and a cheap, comfortable home or shelter in winter, and a little assistance from man to protect her against her enemies. The succession of flowers through the season, affords rich and ample pasturage for the bees. Though the amount of honey in a single flower is very small, yet when the whole product of the season has been gathered, it will be found to be immensely great. Only a small portion of the whole is now saved and stored. Any ordinary sized farm will support several colonies, and in locations where red and white clover, mignionette, buckwheat and other

flowers whose yield of honey is large, abound, the stock of bees kept may be increased. I think there is no location in our country which is not capable of supporting a good sized apiary, and if well managed, it will pay the owner a good dividend.

Probably one reason why so few have engaged in keeping bees, has arisen from the prevalent notion that the success and profit are merely a matter of luck or chance. But it is now a well settled conviction among all intelligent apiarians, that success in this, as in every other business, depends chiefly on the proper management of the bees. There will of course, be larger products some seasons than others; it is so with almost every crop we raise on our farms. An extremely wet, or extremely dry season is generally less favorable to the largest field of honey, than one between the two extremes. But a healthy stock of bees will do something for its owner every year; if he takes good care of them, they will repay him. If he attempts the culture of bees and depends entirely upon luck for success, he will be likely to fail. He may be prosperous for one or more seasons, but failure in the end is pretty sure to come. So if he attempts to raise corn, wheat or barley, or any other crop, and depends entirely on luck, he will soon fail in these crops. Wise, careful, proper management, is the only sure road to success. Procure good hives, keep the colonies strong and vigorous, see your bees often, look into the hives, watch for the enemies and destroy them, and you may reasonably expect a large return for your labor. When men have learned to manage the bees aright, and keep them in sufficiently large numbers to collect all the honey which our Maker distributes in the flowers throughout our land, hundreds of pounds will be raised where one is raised now.

Another reason why many are reluctant to keep bees, is on account of the little weapon with which they are armed, and the great freedom with which they use it on most of those who approach them. Now we would not deprive them of their only means of defence, if we could; for if so, a thousand lazy depredators, including men, would prey upon the products of their industry, and leave them to starve; and the whole race of this industrious insect would soon become extinct. The better way to get along with their irritable tempers, is to learn to treat them well. They are like some men in this world—easily managed, when one knows how; but irritable and pugnacious and passionate, and easily provoked to use their means of defence, and

exceedingly difficult to live with on peaceable terms, when one does not understand their character or know how to manage them. But it is worth while for us who live in this world, to learn how to get along comfortably with all the varieties of character which we meet. And we can learn a lesson in the treatment of the bee. The less fear we have of them, the better we can deal with them. Then we can be calm and quiet in our motions, and can move among them and soon seem to handle them without provoking or disturbing them at all.

The bee is endowed with the keenest sense of smell, and there are some persons whom they seem to utterly dislike. As soon as such persons approach them, they rush at them and attack them without mercy, and drive them away. I have seen them do this when I was moving among them unnoticed. The breath of a person, especially inside of the hive, is offensive to them. I suppose there is a peculiar odor attendant on every person, and their sense of smell is so keen that they instinctively form their likes and dislikes. I have never seen my horse, when in perspiration from labor in the field, come near the hive without being stung; and when I have come up from the field in a perspiration, I have fancied they did not like me as well as at other times. I have no doubt that the free use of soap and water over the whole person, has something to do with making a man attractive to his bees, as well as to people generally with whom he holds intercourse. I am inclined to think that there are very few, who cannot learn to treat bees so well that they can manage them without any serious difficulty. It is only in and around the hive that we have any difficulty with the irascible tempers of bees. Those who do not like too close personal intercourse with them, and are not ready to put implicit confidence in them, and withal still retain a slight fear of the unmerciful use of their weapon, may easily protect themselves, so that they may visit their hives with entire impunity.

Bees have a great aversion to tobacco smoke. The pipe or cigar is convenient among the bees; but as I do not advise any one to use either, it is better to get a tube eight or ten inches long, and half an inch in diameter, fill this with tobacco and ignite it, and by blowing this you keep the tobacco burning, and throw the smoke from the other end into the hive. Armed with this weapon, any man may subdue the combative propensities of his

bees, render them harmless, turn their anger into submission, and do what he pleases in their hives or with their treasures.

I have seen and will here quote a description of another method of protection, adopted by Mr. Bradley, a successful apiarian in Lee, Mass. He makes his protector of common black coarse bobbinet lace, which draws down over the face and neck. Two yards long and three-fourths of a yard wide, is sufficient to make one, the piece being cut in two, and the edges of the two halves or pieces being sewn together in the form of a common grain bag without a bottom. A piece of small twine, a yard long, is then run into one end of this bag-shaped protector, so that it draws up like a lady's work-bag. The crown and rim of the hat will keep the meshes of this lace protector from coming in contact with the face or neck, while the string will close the lower end round the chest. The whole will cost about fifty cents. This is better than the gauze wire protectors. A common pair of leather gloves completes the armament, though Mr. B. "handles them without gloves."

In going about and examining into the condition of his hives, Mr. B. uses a dry piece of rotten hard wood, such as is usually called punk. Punk burns slowly and steadily, without a blaze, but with smoke enough to fumigate a ship. With this little piece in hand, he blows a little smoke into the hive through the entrance. This should always be done in warm weather, before raising the top of the hive to look under, or to examine for moths. It has the effect to frighten the inmates, or at any rate to astonish them so much as to throw them off their guard, so that he can handle or do anything with them with perfect safety, by being gentle and careful. This mode of smoking is always used in removing the honey boxes or surplus honey from the top of the hives. "On all occasions, in fact," says Mr. B., "in your operations with your bees, use this smoke. It is perfectly harmless—a single good smart blowing on the lighted punk, is quite sufficient to prevent all nervousness on the part of the bees, and it is astonishing to see with what perfect freedom they can be handled, and with what affectionate docility they climb and crawl, in great numbers, over the master's hands."

I will here allude to the Italian bees, not for the purpose of expressing any preference for either one over the other, but rather to provoke discussion, and call forth the experience and preference of others. Some are much prejudiced against the Italian bee, and

others are as thoroughly in their favor. Mr. B., to whom I have alluded above, has thirty or forty swarms of Italian bees, which he has kept some four years, and considers them superior in several particulars, to our common black bees. In the first place, they are more industrious. In proof of this, he states that, in the spring of 1863, he carried nine swarms of common bees, all strong and healthy, and one small swarm of Italian bees, about twelve miles from his own apiary. It proved a very unfavorable honey season in that location, during the whole summer. The result was, that the nine swarms of common bees made seven boxes of surplus honey, and cast seven young swarms. The swarm of Italians made one box surplus honey, cast one swarm, which filled its hive and one box surplus, and also cast a swarm. All these swarms of Italians wintered well without feeding, while three or four of the common swarms required to be fed, to get them through the winter. In the spring of 1864, he carried two swarms of Italians about three miles from his home apiary, and made them into non-swarming hives. From the two swarms of common bees he took one hundred and six pounds of surplus honey, while from the two swarms of Italians, he took two hundred and three pounds.

In the second place, the pure Italians are less inclined to sting—so much less, that they can be handled almost with impunity, without fear of their sting. The reason why so many bee-keepers are prejudiced against the Italian bees, on account, as they say, of their being so irritable, is that they have got "hybrids," or half-blood queens, which have been sent to them perhaps for *pure* Italians, and they do not answer the recommendations. They consequently discard them without a fair trial. The progeny of these half-blood queens are more irritable than the common bee, though in most other respects they have the characteristics of the pure Italians. In the third place, they are more prolific, and swarm earlier and more frequently. They are stronger, more courageous and active in self defence against other bees, and are seldom robbed; while on the other hand, they are not inclined to rob other swarms.*.

In a letter just received from R. D. Paul, enclosing an advertisement of Italian bees for sale, he says, "after having twenty-five years experience in bee culture, and having proved the superiority

* See Thirteenth Annual Report of the Massachusetts Board of Agriculture for 1865.

of the Italian over the native bee," &c. I do not know how long he has kept the Italian bees, but he seems convinced that they are superior to the common bee. And the experience and testimony of Mr. B. of Lee, Mass, are certainly worthy of serious consideration.

Without referring to any of the patent hives, or expressing any preference for one over the other, it may be enough in this paper to say, that it is not difficult for any person to make a hive at a small expense, with a box attached on the top, capable of holding twenty-five pounds or so of honey, which will answer all ordinary purposes for the common farmer. The hive should be neither too large nor too small. A good size is about thirteen inches square by fifteen inches deep. The box may be of the same size of the hive, by about five inches deep, made wholly of wood, or with glass sides, according to the preference of the bee-keeper. Two or three holes, more or less, an inch square, should be made in the top of the hive, and corresponding ones in the box, through which the bees enter to work in the box. If any one desires to have annually a moderate quantity of honey—forty or fifty pounds, with little trouble, and does not care to increase his stock of bees, or to spend much care or thought on the matter, he may build a small house—four feet by six, or such size as he chooses, and place a healthy hive in it, and the chief part of his expense and trouble is done. If this room is kept dark, no swarm will be sent out from year to year; and the number of bees in the hive will continue about the same for a period of several years. I have kept a hive in this manner more than ten years, and the bees still appear to be in a healthy, thriving condition. The last year, they made about thirty pounds of honey; the previous year five pounds. Some seasons they have made less, when the season was unfavorable, and one or more seasons, upwards of a hundred pounds. Of course there is much less profit in keeping non swarming hives. With good success, at the end of ten years, a non swarming hive will be of the same value as at the beginning. The annual produce of honey will be the only profit. While a swarming hive will send forth a new swarm usually every season, sometimes two swarms, at the end of ten years the product arising both from the honey and numerous colonies, will be very much in excess over the non swarmers.

It is coming to be the general opinion among intelligent bee-keepers, that it is better to keep bees during the winter, in a

house. The bee is warm blooded, and requires food and air to generate caloric, like the ox, cow and sheep. So the warmer they are kept, the more quiet they are, the less food they consume, and the more healthy they will be in the spring. A dry, dark room, tight and warm, with some means of ventilation, is the best place to winter them. Mr. Quinby recommends placing the hives on shelves, bottom upwards, thus affording the proper ventilation. Mr. Bradley adopts a similar method. His winter apiary is a dark shed, lined on the inside with straw, to which he removes his swarms when winter sets in, and where they are kept till spring. He adds, "it is not desirable to attempt wintering swarms that you do not know to be strong, free from all disease, and have plenty of honey. It is from such swarms that we get our profits, and they require the best care, and will winter under most any circumstances—even in the open air without any protection. So will a strong, healthy cow winter by a hay stack, with nothing more for a protection; but would it not be best, after all, for the hay and cow both, to be in a warm barn? So in regard to bees. They will winter enough better in a room or house prepared for the purpose, to pay all extra expense and trouble, and ten times more." Proper care and management bestowed on bees, the highest culture, make them exceedingly profitable. One colony increases in the course of some ten years to about five hundred, where they cast swarms every season. These will produce, say a thousand dollars worth of surplus honey. Is not this a profitable investment? Where can the farmer make a better one? Where else does so small an investment bring such results?

To the lover of Nature, of natural science, natural history, the bee affords an interesting subject of study and investigation, teaches some instructive lessons, and thus furnishes food for thought and gratification for the mind.. Our Creator has endowed us with the love of knowing something about his wonderful works that surround us on every side in this world. It is right that we should cultivate this love, and become acquainted, as far as we can, with his marvellous doings, wrought so continually before our eyes. How many wonderful mysteries are concentrated in the little colony of bees. There comes to mind the song of our childhood:

"How doth the little busy bee
Improve each shining hour,
And gather honey all the day
From every opening flower."

Let us learn to imitate the industry of the bee, her carefulness, wonderful skill, forethought, the order and good government over all our concerns, in our higher life, and it will be well with us.

Mr. Wasson presented the following:

The Farmer's Road to Success.

Success is a hard fact. It comes only inch by inch. Untiring labor, prudence and economy are the pillars of its structure. Five in every hundred of those who enter commercial life, and one in every thirty engaged in lumbering may find it, after years of tug and toil. Agriculture presents no such forbidding aspect. It is true, that but few farmers become suddenly rich, and it is also true, that where farming has passed its transition state into that of a well defined system, founded on a basis of correct principles which govern practice, few remain poor; and when the agriculture of the whole State is thus reduced to a system, it will not be classified as an unprofitable occupation. It is an old maxim, that "necessity is the mother of invention." *That* necessity is upon the farmers of Maine. A necessity for a system of farming, or for a bettering of that system, to overcome that *hard fact* of success.

A variety of causes have combined to strike out the wheat crop from the list of our staple products. We turn as naturally to the West for our bread, as toward our houses to find our homes. Each year is increasing the distance to mill. Each year the wheat and corn bin is found another remove nearer the Rocky Mountains. Each year is increasing the cost of transportation in steady ratio, each adding its quota to help swell the cost, until the prices of corn and flour have reached an almost unheard of figure. But a worse feature of the case is, that a review of the market shows no gleam of hope for a reduction of prices in years to come. What a prospect before us! The flour brought from the West is estimated at a cost of $8,557,500; the corn imported, $4,277,-500; the butter and cheese at $1,500,000; oats, rye and buckwheat, at $500,000—making a sum total of $14,835,000. We disclaim any intention of piling up extravagant estimates to fortify a position. The truth, pruned to the trunk, is enough. Our freight trains, steamboats, lines of packets and numerous coasters, with their cargoes of corn and flour, plying their vocation with all the industry of the bee or ant, tell enough of stubborn facts, without the aid of fiction.

Has the sterility of our soil, or has the sterility of our culture created this enormous importation? If attributable to the barrenness of our soil, our precepts are proverbs to delude us, our practice examples of probity of conduct, which evince more of sincerity than sanity. Taking it for granted that our system is defective, that we have become blinded to our true interests, we may rid ourselves of this excessive burden by producing what we purchase, and simply by enacting a higher grade of farming. What has been achieved across the water, may in the same way be achieved on this side of the Atlantic.

The soil of England, which had been cultivated for a thousand years or more before Columbus sailed on his voyage of discovery, is now yielding three fold more than at some former periods. The same is true of Saxony, Bavaria and others of the German States. What the hand of man did there, the hand of man may do here. Turn to the Genesee valley—the granary of the West in the days of our boyhood—what the hand of man has done here, has been repeated there; till their handiwork like ours, has plucked the very elements of fertility from the soil, sifted out and sold the ash-constituents of wheat and corn—a process westward in its course, prosecuted with an unsparing hand, till the width of continent is spanned, and standing on the banks of the placid Pacific, we look in vain across its almost illimitable bounds for other virgin soils to rob. Hard facts are these, varnish or gild them as you may. What is to be done? That our soil and climate are as capable of producing wheat and cereals generally as any other part of British America, there can be but little doubt. That success in farming in Maine is as accessible to us as to those States of Europe where shines the same northern sun, or blows the same Arctic winds, science and observation have determined.

The time has come which calls loudly for a reform, Each day's delay augments the necessity. No longer can we put off the hour when we must learn to farm better, or learn to live poorer, when we must measure out more manure to our farms, or measure out less bread to our families. A radical change must arise from the ashes of a consumed conservatism. To inaugurate a reform, we must first stop that culpable waste of our manure heaps, five-sevenths of which may now be shedding its fragrance on the desert air. Farmers may expatiate on the misery which is to follow when thrown on their own resources; but we see no reason why such a course of events must be deprecated—indeed, we fail to see why such a course is not the most to be desired.

In France, from 1820 to 1850, the cultivated area has increased fifty per cent., whilst the produce has doubled itself. In Great Britain, the increase in the average yield of wheat per acre has been forty per cent. in eighty years, or from 1770 to 1850. Subsequent to 1850, the law-makers of England, losing sight of their own dear selves in that of the interests of the country, repealed or modified the corn laws. Would that American legislators, seized with the same kind of infatuation, so far at least as to occasionally remember that their constituents too, have rights, to be regarded and protected. The result of such English legislation was that the average yield per acre, aided by an improved method of farming, extension of drainage and artificial manure, raised it to a higher figure than ever attained before—that of twenty-seven bushels in England, Wales and Scotland, and twenty-five bushels in Ireland. In Switzerland, Holland and Bavaria, where they have learned what we must learn, how to economise resources, the soil is made to double its capacity. The same is true of the older countries, China and Japan. The same will be true in Maine, when her farmers revise the order of things—when the making and saving of manure shall become the rule rather than the exception, when instead of preparing the seed-bed and guessing as to the amount of crop, the soil will be stinted and forced up to the limit. English agriculturists to accomplish this, explored the caves of India, the battle-fields of Europe, the coasts of Africa and the islands of the Pacific, for elements of fertility. Let the farmers of Maine emulate the example of their English cousins in this regard, fix the average yield at a high standard, and when the resources of our own farms are exhausted in the trial, call to our aid artificial and commercial fertilizers; not from India, Europe, Africa or the Pacific, but from Cumberland and Hancock, Lubec and Rockland. We can let the world alone, and procure for the wants of our farmers an ample supply of phosphates, guano, gypsum and lime, to meet every exigency in the case.

Is some commercial fertilizer wanted, with its phosphate and nitrogen, to exert a vigorous influence upon the growth of plants, a fertilizer that can be recommended to the farmer who does not wish to spend his money foolishly, who would buy that which is trust worthy, guaranteed by a previous chemical examination? He can buy it of the Cumberland Bone Company. *En passant.*

Should these words of mine ever fall upon the ears of the managers of that establishment, I would say to them, if their purpose is immutably fixed to send out only a pure article, free from worthless adulterations, if what has been put into the market are but samples of that which is to follow, I very much misconceive the shrewdness of our farmers, if they fail to appreciate its value. If a fertilizer is wanted, one exceedingly and quickly efficacious, chiefly ammoniacal, we have it in fish guano, or porgy chum. Have we a soil rich in the insoluble elements of fertility, lime is the agent to liberate and set them free. Is an agent sought to bind and retain the volatile, winged or golden virtues of our manure-heaps, gypsum is that agent, working silently and too often without recognition or commendation.

With such potent auxiliaries at command to strengthen and enliven the home-made food for our plants, with a saving of all the voidings, liquid and solid, in and around our barns and buildings, and a judicious application of them to supply the wants of vegetation, we may defy both exhaustion and starvation, improve and elevate the standard of farming, till every farmer shall have learned that if we would here reap abundantly, we must manure abundantly. This, and this alone, is the farmer's road to success.

SAMUEL WASSON, *Hancock Co.*

Mr. French, retiring member from Franklin County, contributed the following paper:

The Application of Manure.

Much has been said, and much written upon this subject, and yet the farmer asks, "What is the best method for applying manure—whether on the surface or under the turf, in a green or a rotted state?" It has never been satisfactorily determined in what way precisely manures act in stimulating the growth of plants, and hence agriculturists have differed widely in their methods, the practice of one class being based upon a gaseous theory, which buries the manurial agent deep in the earth, presuming that in process of time its odoriferous particles will be snuffed up by the plant that grows above it, and, as the other extreme, there have been advocates of an entire application on the surface, basing their argument upon what they term the "natural method." We are not going to take issue directly with either of these theories, more than to say we do not think the

arguments adduced sustain the premises, but wish to present some thoughts of our own, suggested by observation and experience.

Every farmer has learned by his own experience that old, well rotted manure—and to a certain degree the older the better—is better suited for an immediate crop, than fresh or green manure as it is termed; but observation teaches him that in passing through a state of fermentation, so necessary to prepare it for immediate use, there is a partial loss of some elements esteemed to be of great value among manurial forces. The question naturally arises, shall I wait till my manure is ripe for use and a part of it dissipated in the air, or shall I apply it immediately and let it ripen in the ground with slower results? So far as our experience teaches us, the crops we raise and the ultimate object of our cultivation must determine our method of application. Every farmer or cultivator is presumed to know his own business—what he is to realize immediately, what he is to expect prospectively. We believe it may be safely laid down as a rule, that when manuring for general purposes, the manure should be applied in a fresh state or nearly so, if it is simply manure unmixed with straw or refuse, and thoroughly incorporated with the surface soil. Just here is where the essential part of the process is left out, and because of the difficulty in doing it satisfactorily many plow it under at once, where a large part of it remains till the next plowing. We are aware there is great difficulty in working in barnyard manure unless it has been allowed to freeze in the winter, but with the coulter harrow and cultivator, and worked on a newly-turned or moist soil, it is soon accomplished and well repays the trouble. We attach a good deal of importance to the advantage that is derived from freezing, and if possible, would have all the manure that is to be used in the spring frozen during the winter. It is not only more easily worked, but is in a better condition to forward the growth of crops, as we have repeatedly proved in the fall preparation of land for sowing—realizing so far as we could observe, very nearly the same advantages where the land was only made ready by splitting open the corn rows and spreading on the manure before winter, as where fully prepared by plowing.

It is objected by those opposed to surface manuring, that what remains unmixed with the soil is dried up by the sun and is useless. We must take issue on this point, and without claiming anything for the argument that surface manuring is the natural method, for nature mulches first, and carries on the manuring

process beneath the annual covering of cast-off foliage, we will put forth the opinion or theory for the consideration of our agricultural friends, that the sun, instead of destroying the value of manure that is left or dropped on the surface, seals it up so effectually as to prevent evaporation, while decomposition takes place within the mass. It is by this method, as it seems to us, that the valuable portions of the excrement of our stock while at pasture are preserved, while decomposition takes place preparatory to the solution and distribution of its nutrient properties by agencies that are ever at work. So far as our observation extends, pastures on which the stock is herded as well as pastured, do not run out, but retain their fertility if kept clean and not allowed to be overrun by bushes and brakes. Especially is this true of pastures and even fields on which sheep are kept, but will not of course hold good of those where cows run and are yarded over night.

Lands in pasture may well be said to be in a natural state and fertilized by natural methods, and this too without the advantage of having their manures incorporated with the surface soil; but if we were to suppose the manure voided by our animals while grazing was immediately buried eight, ten or twelve inches, the question might well be asked, when may an adequate return be expected?

Great stress of argument by those in favor of plowing under manures, is laid on the escape of ammonia and other volatile parts of manure, and the loss occasioned thereby. When manures are moved in a high state of fermentation, there is loss occasioned by the escape of nitrogen set free in the heated mass; but this action soon ceases on exposure to the sun, as is evident from the loss of its pungent odor. We do not consider it longer an open question, as to how plant food is assimilated in vegetable growth, as between the two theories, whether in a liquid or a gaseous form; but that the elements of nutrition are taken up mainly if not entirely, in some form of solution. This principle seems equally applicable to those elements of a gaseous nature as to the more solid forms, inasmuch as they appear more active in a moist atmosphere than on clear, dry days.

We have so much faith in the practical workings of the views herein expressed, that we have our practice conform to them; and do not hesitate to recommend that in the general system of farming as pursued among us, the bulk of manure be applied in a

fresh state on the surface, and be thoroughly incorporated with the surface soil to a depth not exceeding five or six inches, unless a great quantity be hauled on at a time, when a corresponding depth of earth must be stirred. We deem it better that application be made each year that the land is tilled, rather than all at one time; as by so doing it becomes more evenly distributed through the mould. This method of application does not exclude, but rather includes the use of what old manure the farmer has on hand for the benefit of his grain and hoed crops, because of its immediate availability in increasing the growth of these; and if these be his sole dependence, he will, as a matter of economy and profit, use no other.

Our practice has been for twenty years or more, to break up our green sward either fall or spring—generally in the spring just before planting—spread on green manure at the rate of three cords to the acre when using old manure in the hill, and when not, doubling the above amount spread on. The old manure that is carted out of the yard in the fall, together with the dressing from the hog yard, &c., is applied at the rate of four cords to the acre in the hill. In the spring or fall following, again apply a coat of green manure as at the first, and this time plow under with the seed plow, sowing to wheat or barley, and seeding to grass.

In the spring of 1862, we tried an experiment by way of comparing the two methods generally practiced. Part of a three-acre piece that was to be planted to corn was marked out, and manure of like quality and equal quantity with what was used on the rest of the piece, was spread upon the sward and plowed in eight inches deep. In other respects it was treated like the rest of the piece; but when the corn had attained its growth, this plot could be easily traced out by any one standing where he could look over the corn—it was at least three inches less in height than the rest of the corn, and equally wanting in other respects, on comparison with the rest of the piece. At the time of seeding down it was all manured alike; but a like difference was noticable in the growth of the wheat, and has been more plainly seen in the yield of grass.

In 1865 we repeated the experiment in a different form, this time taking two pieces of ground of equal size and lying side by side, on one of which was spread on the sward and plowed in ten inches deep, all the manure that was to be applied in that manner, and on the other piece, half that amount was spread on the furrow

before planting, and the other half before sowing. The effect on the crops was even more marked than in the other case, particularly so in the grass—the difference being discernible for more than a half mile. These two experiments are making positive to me by results, what I fully believed before in my theory and practice.

The application of special manures, and their kind, must be determined by the character of the soil and the ability of the farmer to make present outlay. With a view to test this question, a year ago last May we measured off three half-acres on a corn field that had been similarly treated by a top dressing of green manure, and was to be dunged in the hill from the same heap. The first half-acre was simply manured in the hill; the second had in addition a tablespoonful of plaster dropped on top of the manure; the third a teaspoonful of raw-bone super-phosphate. The difference in the appearance of the plots was noted through the season comparatively. On the part where only the old manure was used, the corn made a good growth; on that where the plaster was applied, it was *very* much better; and where the super-phosphate was put, it appeared the first of the season to be of a ranker growth and darker color; but on harvesting could see but little difference between the effect of this and the plaster, while the difference was very manifest between where these two agencies had been used and where neither was applied.

The past season we continued the experiments with plaster and super-phosphate, but in a more definite manner—taking one acre of ground for each. After the usual dressing of green and old manure, nine-tenths of the rows on one acre were treated with plaster at the rate of two hundred pounds to the acre, one-tenth being left with only the old manure in the hill, and like portions of the other acre were treated with raw-bone super-phosphate at the rate of one hundred pounds to the acre, (or it was intended to be so applied, but being absent at the time it was put on, that figure was not quite reached.) The rows left without either plaster or super-phosphate were through the middle of the piece. The effect of the special manures applied was plainly visible through the season, that where the plaster was put on seeming to be of a ranker growth, but on harvesting, that on the super-phosphate appeared to be better filled out; the yield in both cases being at least one-quarter more, and earlier than where only the old manure was used.

After repeating experiments and observations, we are free to say what in our case we deem the best methods of applying manure, viz.: That the bulk of farm yard manure be spread on fresh from the heap and thoroughly mixed with the soil, there to ripen, using the old manure and such special manures as we may choose for hastening the growth of our special crops.

Accepted, with the following resolve attached—(offered by Mr. Carpenter of Kennebec :)

Resolved, That so much of the conclusions in the report of the ex-member from Franklin as relates to the application of Plaster, be considered as having only a local value.

E. R. French, *late member from Franklin Co.*

Mr. Chamberlain of the Maine State Society, presented the following report on

Alsike Clover.

Alsike Clover is a species of clover that reached this country ten years ago, or more. Its name is obtained from the parish of Alsike in Upland, (Sweden.) It is found in a wild state through much of Sweden, also in Norway and Finland. In the present century it has been introduced into cultivation through those northern countries, and is now known as Swedish clover, in England, Scotland, Denmark, Germany and France. It was early distributed to different parts of this State by the Secretary of this Board; but I fear it fell generally into the hands of careless men. Unless it has recently spread in Aroostook beyond the neighborhood where it was highly prized some years ago, it has not yet received much attention anywhere in Maine. The few seeds I received, came after my spring seeding, and in looking for a place to plant them, I saw a rough border by the fence, where I had plowed a recently cleared field—having set the fence nearer the wood than I could work the plow. On this spot I scattered the seed, and worked the ground a little with a hoe.

The clover still holds possession of the spot; and as the field has now been mown several years, it has sometimes been cut in with the hay, in other years cut for seed.

As an experiment, while seeding a field to grass, I sowed one square rod in the middle with Alsike clover. I cut it for seed three years in succession, each crop being a luxuriant one. The

grasses then worked in, but the Alsike was still there at the last haying—which was I think, the sixth crop.

Last season I had half an acre of clean Alsike, that attracted much attention from farmers, many estimating it at one and a half tons of hay on the half-acre. I cut it for seed, and think it would rather exceed than fall below the estimate. This was on land that never had received any manure, except with the barley crop in 1866, when the clover was sown, and on the clover in 1867, 100 lbs. of Cumberland Super-Phosphate was sown each year. Having had an opportunity of observing this clover in a small way and by noting it carefully as hay and as a forage for soiling, I can only conclude that it is a plant admirably adapted to this State, and one possessing so many excellent qualities as to render it worthy of special effort to extend its cultivation. If anything I should say here, encourages a careless farmer to try the Alsike clover alone for a hay crop, I would have him understand that he had better let it alone, unless he can give his field so smooth a surface that his scythe or machine can cut low; as the clover, if of any great weight, is sure to lodge pretty flat.

Compared with the two other clovers before known to us, the Alsike differs so as to disclose to me the following characteristics:

1st, It is hardy, more permanent than the red clover, and retains its hold many years.

2d, It branches very much—throws out many stalks from one root; thus affording a good crop with thin seeding. Indeed, I think it should be sown thin, that the roots may have room, so as to obtain strength to strike deep into the subsoil.

3d, It bears cropping by cattle well; thus proving its adaptability to pasturage.

4th, It continues longer in condition to be cut as hay than any other forage plant that I know. It throws out a great number of heads from each stalk, coming into bloom successively for a month or more. When the most of the heads are ripe, the stalks and leaves are still in condition to make excellent hay. My seed crop has always made good fodder after the seed has been threshed off.

5th, I believe it to be the best honey-plant in the world. Much attention has been given to the habits of the honey-bee in regard to its choice of flowers, and to quantity and quality of the honey stored in different portions of the season. We often see a new plant recommended for cultivation specially for the bees. I think bee-keepers now generally agree that the surplus honey is all, or

very nearly all stored during the bloom of the white clover. From all other flowers including buckwheat, but little more is gathered than is consumed daily. I have for several years had on my place a plat of Alsike clover beside one of the white. I have often called attention of people to the working bees on the plats; and it was always easy to see that the Alsike had the greater attraction. Equal areas usually show twice the number of bees on the Alsike. The blooming season is longer on the Alsike. The heads are also more numerous on that variety. A field of Alsike clover is the best patronized bee-pasture I have ever seen—exceeding that of an orchard in full bloom, I am sure that, in a neighborhood of Alsike clover fields, bee-keepers would not be searching for other plants for their use.

CALVIN CHAMBERLAIN.

Mr. Prince of Androscoggin, presented the following:

Report on Root Crops.

The cultivation of root crops in this State, we believe has not received that attention its importance demands, either from the farmers of our State or by this Board. Indeed, were it not for the potato rot, we should not, from a careful examination of the proceedings of this Board for several years past, even dream that roots were raised in Maine; hence we fear that in undertaking to report upon this topic we are, so far as this Board is concerned, approaching untried waters. We shall not, in this report, treat separately upon all the roots raised in this State, but shall confine our remarks generally to the mangold wurzel, and Swedish or ruta baga turnip, believing these to be the most important roots for field crops (potatoes excepted.)

The great difficulty in raising roots in this State, has been that they have been made a secondary object. Farmers having done the bulk of their planting and sowing, have called their spring's work completed; and it generally has been, unless perchance they had some little spot that was too wet to plant or sow in the ordinary time. In this case they have usually scraped up a little dressing and sowed a few roots. It now being the season for the June drouth, but a small portion of the seeds germinate, and what do bring forth a little plant, that at this season of the year has to struggle with the maggot and drowth, and between the two present a very sickly appearance. The owner becomes dis-

couraged, and unless there is a dull day in haying, they are neglected until it is too late, and the inquiring neighbor is assured that roots are a very uncertain crop. We would not overdraw the picture, but believe the above is the experience of many farmers in this State.

To raise good crops, they must be made of primary importance—put in in good season, and taken the same pains with as other crops; and then we believe they will not only be a sure, but a profitable crop. What farmer is there that cannot with a good degree of certainty raise good crops of turnips, beets or carrots, in his garden? and if in a small bed in his garden, why not his acres in the field?

For neat stock we cannot recommend turnips; but would raise mangold wurzels for milch cows, as they contain a large quantity of sugar. For sheep, we believe there is no crop that equals the turnip. They eat them readily, and we find from experience that nothing is more conducive to the health of the flock. The great portion of the year during which our stock is necessarily fed from the barn, renders it of the greatest importance that we should not only endeavor to keep them alive, but thriving; so that the idea of "spring poor" should become obsolete.

In the culture of mangolds we would use well rotted manure, thoroughly incorporated with the soil. The quantity can hardly be too large. For turnips, green or unfermented manure in the drill, and well covered. The rows should be from twenty-six to twenty-eight inches apart. We would sow either the mangold or Swedish turnip as early as we would plant corn. The plants then take root before the early summer drouth, and usually before the appearance of the fly or maggot. The young plants will usually appear in about a week after sowing, and as soon as they show a pretty strong third leaf the process of hoeing and thinning should commence; for if they obtain too great size before being thinned, they are more liable to be injured in the operation. The young plants should be left a few inches distant at first, and afterwards as they increase in size, should be again thinned to about one foot distant. In this way they will be injured but very little in thinning, and may also be transplanted with the assistance of a trowel without material injury. The transplanting of either mangolds or turnips (especially the former) is not recommended except to fill up any blanks that may occur; then to be done with the utmost care and in favorable weather. Great care should always be

observed in the after cultivation of the mangold, as the slightest wound is apt to increase with its growth, and in many cases greatly injures the root; in fact, we know of no other root crop so susceptible to injury of this sort as the different kinds of beet. Some writers recommend removing the lower leaves of turnips and mangolds during the latter part of the summer, and feeding them to stock; but this practice we deem of doubtful expediency.

Our method of harvesting turnips is to use a sharp hoe, and with one clip take off the tops; then strike one corner of the hoe under the turnip, and you can draw it very easily. We take two rows at a time, throwing the roots into the space between those and the next two. In this way we leave room enough between the rows of roots to drive a cart. We let them remain long enough for the outside to become dry, and then drive between the rows and throw them directly into the cart; in this way saving much hard work that is necessary when a basket is used.

Dr. Voelckler says that the mangold is justly esteemed on account of its fattening properties when given to beasts, yet it appears to be about the worst description of roots that can be given to sheep, on account of it laxative qualities. He further says that he has learned that this observation is confirmed by many practical farmers; therefore mangolds ought not to be given to sheep.

The turnip was introduced into England from Sweden about one hundred years since, and has been gradually growing in estimation until at the present time it is considered one of the most important field crops, and is used very extensively in fattening beef and mutton.

We are aware it is often said that the soil and climate of the British Isles are more favorable for the growth of root crops than ours, but we do not think the same remark can be justly made with regard to the Canadas; and to show what is done there in raising these crops, we will make an extract from an address before the New York State Agricultural Society in 1864. "In a match between Hamlinton and Wentworth Agricultural Societies in 1862, there were three entries of carrots averaging nine hundred and twenty-one bushels per acre, and three entries of beets averaging one thousand thirty-one and one-half bushels per acre. In 1864 the agricultural societies of North and South Wentworth had a 'turnip match,' and as the report of judges is very full and instructive I make some extracts from it.

1st. Four and one-half acres Skirving's purple top; soil, light loam; wheat stubble, manured and plowed; two pounds of seed per acre, in drills two feet apart; sown from 26th to 27th of June; thinned and hoed twice; cultivated twice; yield of piece, 835 37-60 bushels per acre.

2d. About eight and one-half acres, principally Matson's and Skirving's; soil, black alluvial, clover sod; manured with twelve loads of barn yard manure to the acre; plowed in the fall and again in the spring; three pounds of seed per acre; sowed June 15th and 16th, in drills twenty-six inches apart; thinned and hoed twice; cultivated three times; yield 558 bushels per acre.

3d. Six and one-half acres oat stubble; manured in fall with sixteen loads barn yard manure per acre, and plowed nine inches deep; plowed again in the spring and cultivated; seed sown 9th, 10th, 11th and 13th of June, with purple top Swede, Matson's, and Skirving's improved; drills twenty-eight inches apart; manured in the drills with three hundred pounds of bone dust per acre; soil, clay loam; yield 633 ½ bushels per acre.

4th. Five acres purple top; soil, clay loam; oat stubble plowed in the fall and spring; manured in the drills with ten loads of farm yard manure and two hundred pounds of Coe's super-phosphate of lime per acre; two pounds seed per acre, sown on the 15th to the 21st of June, in drills twenty-eight inches apart; yield 781¾ bushels per acre.

5th. Five acres half Laing's, half old purple top; soil, black, alluvial and sandy loam; oat stubble, manured with eighteen loads of farm yard manure per acre; plowed with trench plow in the fall, cultivated, harrowed and plowed; plowed again last of May, harrowed and rolled; three pounds seed per acre, sown 15th to 18th of June, in drills twenty-four inches asunder; seed came up very irregularly at first; horse hoed 12th July; commenced thinning July 20th; plants eight to ten inches asunder; horse hoed 3d of August and hand hoed again; yield 628 ¼ bushels per acre.

6th. Three and one-half acres King of Swedes; soil, sandy loam; sod plowed in the fall, twice plowed in the spring; manured in drills, fifteen loads farm yard manure to the acre; sowed 15th to 20th of June, in drills thirty inches apart; hand hoed twice; cultivated once; yield 624 bushels per acre.

7th. Five and a half acres King of Swedes and Laing's; soil, sandy loam; oat stubble; plowed in the fall and again in the

spring ; manured with leached ashes and farm yard manure ; sown in drills, twenty-eight inches apart ; yield 704 $\frac{2}{3}$ bushels per acre.

The judges in their report state "that they are happy to observe that the increase of breadth sown is very satisfactory, furnishing as it does every evidence that farmers are beginning to appreciate the advantages of this most invaluable crop. That this season has been one of the most unfavorable for the cultivation of the field root crops, which has occurred for many years. They also recommend for heavy upland soils the Skirving's, and Skirving's King of Swede and for alluvial, and lighter and loamy soils, Matson's and Laing's purple top."

With regard to the potato, which has come to be regarded as almost indispensable in every household, we have but a word to say. We would plant good sized tubers, cut or otherwise, in moderately rich, dry soil. We are aware that many believe small potatoes to be equally as good as large ones, but we do not believe that potatoes are an exception to the rule that "like begets like." The distance between the rows should be at least three feet, and the hills not more than one and one-half or two feet. They should be hoed at least twice, and hilled up an inch or two. The last hoeing should be before the blossom appears, for if hilled later the plants will be likely to form a new set of tubers, which will not only fail to reach maturity, but will draw nourishment from the others, thereby injuring the crop.

Potatoes should be exposed to the sun and air as little as possible, as exposure makes them watery and insipid—but as we said before, we propose to say very little with regard to the potato, and this little we will close with an excellent summary of the qualities of this root, taken from an essay by H. C. Worsham, in the Philadelphia Journal of Medical and Physical Sciences. "Having its origin in a warm climate, it was supposed to be intolerant of cold, and on that account incapable of cultivation in a more northern climate; but experience has shown the contrary, and the potato is naturalized in almost every region. It is one of the greatest blessings which the soil produces, forming flour without a mill, and bread without an oven, and at all seasons of the year an agreeable, wholesome dish, without expensive condiments."

RUFUS PRINCE, *Androscoggin Co.*

Mr. Ayer of Waldo, presented the following report:

Increasing the Fertility of our Farms.

"How shall we increase the fertility of our farms?"

I do not attempt an elaborate argument on this most important subject, but shall offer some practical suggestions, hoping thereby to provoke profitable discussion.

In the first place we plow too much; thereby compelling us to spread our manure so thin that we can scarce see it, or its effect on the crops. The average of our farmers, judging from careful conversation with many of them, cultivate in hoed crops and grain about one-fourth of their fields, and by the same means of information, I set the crop of hay to fall short of one ton per acre. Now let us examine a farm having forty acres enclosed in fields, and see how much manure the plowed ground will be likely to get per year, under our wasteful system of keeping the same. A fair estimate, I think, of manure from thirty tons of hay, which is as much as we have harvested, would be about forty loads of three cord feet each. Now suppose one-half of this plowed ground to be in grain; this being five acres, it may possibly produce five tons of straw, which if fed out to cattle and used for bedding in stalls and pig pen, together with roots and grain fed to swine, will perhaps furnish seven or eight loads more; and if we mix the contents of the privy and hen house with two or three loads of muck, which is better than some of us do, so much more is saved, making in all about fifty loads. Now if we dress but once for two crops, which is the more common practice, and take but two crops before seeding down to grass, we have the whole of ten loads per acre; and what does that amount to? The answer is easily found in the crops, of which the grass shows the most decided lack of food, because the preceding crops have almost exhausted the manure, since generally it is mingled with the soil to but a very small depth. But it may be asked, what better can we do? I answer, plow but half as much, and that a great deal deeper, and incorporate the manure more completely with the earth, and see what the results will be. One illustration of this practice I will give. In the spring of 1860 an acquaintance of mine found himself with old manure enough to plant four acres of corn in the usual way, but desiring to raise a large crop, and also try an experiment, he concluded to plant but half that amount, and prepared his ground by spreading about one-third of his ma-

nure upon the surface, which he plowed under to the depth of ten or twelve inches, then harrowed and spread another third of the same, plowed about six inches, harrowing again, and again after spreading the last third; then planting in the usual manner except much thicker. We will not doubt this crop was well tended and carefully harvested, the product being eighty-five bushels per acre of shelled corn, by actual measurement. After corn harvest the ground was plowed as deep as the first time and harrowed down, in spring sown with wheat about the first of May, producing thirty bushels per acre. But the best part was yet to come, having yielded from two to three tons of hay per acre ever since in one crop per year; and so well satisfied is he, that he follows about the same course to the present time; and could I give you a detailed history of the farm operations of the the late Horace McKenney of Monroe, in this matter of crops, I think it would be very much like what I have just stated;—having brought his farm in about ten years, immediately preceding his death, from cutting sixty tons of hay to not less than one hundred and sixty.

I know this is describing but one step towards a better husbandry, and will be found very incomplete, unless we take more pains to add to our manure heaps, and save the liquid portions of what we now get. Methods for doing this are so often described that I will content myself here with relating the practice of one who has neither barn cellar nor vaults.

In autumn he takes up the rear planks in the stables and cattle pen, filling under the floor as far as convenient with swamp muck, which he allows to remain one year before disturbing it, then hauls to the corn field for next spring's use, taking care to replace it with muck as before. This muck thus saturated with urine, he finds quite as good for corn as the well rotted solid excrements of cattle or horses. The urine from the house he puts to another purpose, viz., top dressing for plum trees and other small fruits Each morning in summer it finds its way directly to the roots, in winter it is thrown upon a box of ashes to be used in same manner when spring opens. He claims astonishing results for this apparently small saving.

But the fields are not the part of the farm which I think need the most attention at the present time. The condition of our pastures is a matter of more general concern among farmers than anything else, and well may it be, for no uncommon saying among

us is that this pasture will not carry half the stock it would fifteen or twenty years ago; yet this complaint never comes from farmers who keep cattle and sheep together in summer, or alternate their feeding ground between the two as often as every four years. I have for some time been convinced that pasturing exclusively with sheep made the richest and fattest of grazing for cattle, while at the same time it became miserably poor for themselves; and I have been strengthened in this opinion with each farm looked over, and every farmer conversed with touching this point. I will give the history of one farm in Kennebec county so far as I know. It was long owned and occupied by John Hunnewell of China. From 1840 to 1862 he was extensively known for his fine herd of Durham stock, and frequently quoted as a model farmer and excellent breeder; but during the latter years of his experience in that branch of husbandry, he found an increasing difficulty in keeping his stock in summer at the desired point of excellence, and somewhere about 1850 or '52, owing to the poverty of his pastures, decided to make a change from cattle to sheep, disposing of all his Durhams and increasing his flock to two hundred or two hundred and fifty sheep, trusting by the experience of others that they might thrive where cattle had but poorly lived. And he was not disappointed; for quite a number of years getting good returns both in lambs and wool, but after some eight or ten years he found a change, his lambs not growing so well and his sheep showing a decided lack of something which has compelled him to hire a large part of his flock pastured away from home for several years past, and has now cut his flock down very much, not for want of hay, for he cuts much more than when he commenced with sheep, but wholly because they have spoiled the pasture for themselves. He now tells me there are but two things he can do with the pastures; one is to plow them up, crop and seed down to grass, or change to cattle again, both of which methods he has commenced.

I will now add my own experience in this direction. I have always kept about sheep enough to eat one third of my hay, that number requiring at least one-half of the pasturing, either keeping them together or changing every few years at least—cattle to sheep and sheep to cattle. And I find my pasture at the present time, with the exception of about ten acres, which are always bare in winter, as good for all purposes as when I first owned them sixteen years ago, having carried as much stock the past two

years as ever within my memory, from which I draw the following conclusion, viz., that all our pastures need a judicious stocking with cattle *and* sheep, *alternating every year*.

PETER W. AYER, *Waldo Co.*

Mr. Norton of Franklin Co., presented the following report on

Apple Orchards.

Every attentive and reflecting observer among that portion of our population who are interested in agriculture, has doubtless come to the conclusion that if the natural resources of the State are ever developed, the apple must become a great staple crop. I deem it to be demonstrated that the apple tree is as well adapted to the soil and climate of considerable portions of the State as any indigenous tree whatever. This is shown by the fact that in the older settled portions of the State, apple seeds, by whatever means scattered, by the roadside, in pastures, and about stumps and rocks, have not only germinated, but have successfully competed in growth with the wild cherry, birch, maple and other trees, so that a foreign naturalist might as naturally conclude the apple to be indigenous as either of the others. In fact, on many farms, the apple trees thus planted are nearly all which are to be found on them. We are thus taught two lessons of some importance; first, that many rough and rocky places, unfit for tillage, are well suited for orcharding, as also sometimes, steep banks of gullies and streams; and second, that where the wild cherry and maple can secure a foothold, the apple will do well. Of course if we would have choice fruit and profitable crops in such locations, the trees must be properly cared for.

The number of varieties to be cultivated is a matter of some importance. It is often said that half a dozen sorts are better than a large number. This depends much on the object in view. If it be to send to a distant market, it is undoubtedly true that a small number of the choicest and most productive hardy winter sorts will be more profitable than a large number, which will give greater variety. But we need for home use, and it is the privilege of every farmer to have, if he will, a good supply of choice fruit all the year round; and for this purpose we require, not half a dozen, but half a hundred different varieties. The best of one season cannot be the best at other seasons, and they are also required for different uses and also to suit different tastes. Nobody would

think of eating a Baldwin in September, and no one would regard as worth eating a Sopsevine which had chanced to keep into December. A good orchard should have a well selected assortment of varieties ripening in succession, so as to fill the seasons from the earliest to the latest. In the selection of these we must be guided by observation and experience, and by experiment in testing new and promising sorts, so that eventually we shall have fruit books and catalogues exclusively our own. Much work lies before us in the way of careful observation and experiment before we attain the full development of our natural facilities in the culture of apple orchards, or the profits within our reach in this direction, and it is to be hoped that all who can will contribute to this end and give their results for the public benefit.

J. R. NORTON, *Franklin Co.*

Mr. Stackpole of Penobscot, presented the following on the

Culture of Buckwheat.

Buckwheat is grown by nearly all the farmers in the county which I represent, and is becoming (as it should be) one of the staples of our annual farm crops. It has not yet been cultivated there as much as its merits deserve. It is an excellent cleansing crop, where land has become foul with thistles and other troublesome weeds. It grows so rapidly that it gets the start of nearly all other plants, it completely shades the ground, and keeps down every thing that attempts to grow with it. It is well adapted to newly cleared land full of vegetable matter, and a good crop of this grain can be produced on land that is not in a high state of cultivation. Very rich land causes it to grow so large and branch so much, that it will cause it to lodge, and thereby the crop to be destroyed, or very much injured. Fresh manure causes the crop to so run to foliage that it will not fill. The quick and rampant growth of buckwheat makes it of great value for plowing under for manuring purposes. If desired, two crops may be had in one year, of sufficient growth for this purpose; and as the land requires but little preparation to obtain a good crop of this grain, or of the straw for manuring purposes, I think it is worthy of being cultivated more extensively than it now is. When sowed in early spring or early summer, the hot weather which occurs when it is in full bloom, causes numerous clusters of kernels to blight, and much of the crop to be destroyed; for this reason, the seed should

be sown so that the hot weather will have passed by the time that it is in full bloom. Cool weather, or at least cool nights, are quite as essential to a good crop of this grain, as hot days and nights are to the growth of Indian corn. The point to be aimed at in sowing this grain in every locality is, to put off the sowing as late as possible, and allow it sufficient time to grow and ripen before an early frost destroys the crop. This period occurs at different times in different localities. In that part of the State in which I reside, it is usually sown from the 20th to the last days of June; in the western part of the State, perhaps a few days later would answer. But it will not be safe to sow it much after that time, on account of its liability to be destroyed by frost. Farmers who cultivate it, prize it highly to sow where other crops have failed, or could not be planted on account of the wetness of the land or the lateness of its preparation. The quantity of seed used is from two to four pecks to the acre, the less quantity being sufficient for land in a good state of cultivation. The crop is ready for the scythe when the earliest seeds are fully ripe, many of the rest being in all stages from the blossom to the nearly ripe grain. Much of the unripe grain will ripen after being cut. It is usually left on the field in small bunches, until it is sufficiently dry to thresh; then it should be carted to the barn and threshed out as soon as possible, for it requires a long time for the straw to dry enough to mow away with safety, as it is liable to become moist, which makes it difficult to thresh so as to save most of the grain.

In harvesting buckwheat, great care should be taken to handle it carefully, as it shells easily, and if roughly handled will leave seed on the ground, that will spring up another year and mix with the following crop. Buckwheat is oftentimes ground into flour, and its excellence depends chiefly on the management of the grain between the time of ripening and grinding. When left in the field for several weeks, (as is often the case) sweet white flour is not to be expected; but when harvested in a proper manner, and taken care of as it should be, it gives fine flour, which makes good bread. The miller is sometimes at fault, but practice soon teaches him that in grinding this grain, it will not answer to run his millstones very near together. The value of the grain for feed is universally recognized by those who raise it, the meal being nearly or quite equal to its weight of Indian meal, for fattening hogs or poultry. I consider buckwheat one of the best

grains that I have ever fed to fowl. The straw is not worth much for fodder; it is valuable for bedding, and is esteemed as a mulch for apple, pear and other trees.

E. B. STACKPOLE, *Penobscot Co.*

Mr. Wasson presented the following:

The Ideal Farmer.

"Ideals are the world's masters," says the old proverb. A man's acts tell-tale his thoughts. An opinion is but an ideal, by which, if one trusts his judgment, he is governed, and while he entertains that opinion, it is his master. The Scientist follows—not so much the *real* truth of the science around which his affections cluster, as his conception, his ideal opinion of that truth; and only as his plan of conception is elevated, will he follow its development. Only as the ideal is kept in advance, will he progress.

Among the Greeks, it was more glorious to carry off the palm at the Olympic games, than among the Romans, to obtain the honors of a triumph. The Greek's ideal of honor, was to excel at running or wrestling, not in conquering a nation. The painting of a fish is the Egyptian's ideal of that which is most odious and hateful. The youthful swain's ideal of human perfections, is his betrothed; to him she is the emblem of elegance and purity, though a termagant to all the world beside. Virtue, in the opinion of the Cynics, consisted in renouncing all the conveniences and comfort of life.

How many regard the art of agriculture as the least complex and most simple of all arts—as a resort for fools, an asylum for those deficient in brains, a place to suffer penance in for the crime of having been born without money—that a farm is no place for a person of intelligence and knowledge. The idea of such an one, is that the attempt to find out the nature and mode of the growth of plants and animals he is to have to do with, will only result in a painful search of what he cannot find. In utter contempt he holds "book farming," the almanac, excepted, which occasionally is convenient to tell him when the moon is *magnanimous*, that the pork shrink not in the pot, or the peas shrivel not in the pod. Says Uriel Wright, "if the 'book farmer' has not succeeded, his failure was the result of one or more of three causes: First, the book did not contain the requisite science. Second, if it did, the

farmer did not find it out. Third, he had not the practical experience or industry to apply the knowledge the book contained." Books have been, and are, and will be in all coming time, the repository of science. They are the caskets which contain the jewels of the mind, wrought by genius in every age; yet, unlike the caskets, while they collect, they distribute also.

Example begets example in full fruition. The practice of the father is the ideal of the son. He plows around the same rock-heap, and up to the same headland; one furrow beyond would be sacrilege. The manure heaps, the time-honored frontispiece of the view from his parlor, the well at the foot of the hill, evince a civilization which sighs o'er the days lang syne. His ideas of ventilation are expressed in tight school houses and open barns; oxygen is good for cattle, but bad for children. He believes that all is known that can be known, which tends to multiply the fruitfulness of the earth. The results of his farming are reached in two ways—sometimes by blunder, oftener by accident. His theory is, that the business won't pay. With such an idea, he is right for once. His example comports with his precept. The results prove the correctness of his theory, but not of his premises. His farming is muscle without mind, the hand without the head, too much physical and too little intellectual labor. It borrows no light from the past, it reflects no light on the future. "What a man sows, that shall he reap." Every age and generation has had its reformers. Agriculture has its full share, each of whom, inventors of a theory, hold letters patent of success, contingent upon the purchase of their wares.

A person who uses an imperfect theory with the confidence due only to a perfect one, will naturally fall into an abundance of mistakes; his predictions will be crossed by disturbing circumstances. Ptolemy, to explain his theory of astronomy, supposed the planets revolving in small circles called epicycles. In following out his theory, it became necessary to add new epicycles until the system became unwieldy. If the agriculture of this nineteenth century was as prolific of potatoes as of those unwieldy, cumbrous, complicated, epicycle theories, sweet Erin's living generations need fear no famine. It was only after repeated applications of phosphate, gypsum, lime, ashes and other mineral ingredients, that the theory was shown to be erroneous that these constituents were unimportant to plants, or that their existence in them was accidental. A few simple experiments of Prof. Black's, of Edin-

burg, exploded the long-received theory, that the air was a simple, and the only fluid permanently elastic, although it had received the sanctions of a scientific proposition. All are aware of the principle enunciated by Jethro Tull, a century ago. The great principle of Tull was, that the soil and the air together contained all that was necessary, without the aid of manure. Pulverization of the soil by plows, harrows and rollers; was all that was needed to secure perpetual fertility. The Lois Weedon system is based upon substantially the same theory. As far as the theory enforced importance of pulverizing and of comminuting the soil, so far it worked well; but when it inferred that the principles were applicable everywhere, it failed. In a soil like that around Naples, or where there is a deep, rich subsoil, this theory would work well for thousands of years; while on a shallow subsoil, like that of New England, the crop can only be recruited by manures—just a shallow lamp must be filled if it has actually burned out. In as far as this theory inculcates the belief that fertility is only contingent upon rendering the soil fine and divisible, that, unobstructed, the rootlets might penetrate and permeate the seed bed, it was not true in fact, because but few, if any plants are cultivated, whose roots in a good soil, do not extend entirely below where the plow ever runs, and because the great end in plowing and stirring the soil is to put it in the best possible condition to receive heat, moisture and atmospheric influences from above, connected with capillary attraction from the subsoil below. This is the principle in under-draining, to extend down into the earth the rays of heat and light in proportion as the water line is lowered. Says a writer, "The sun, the ocean, the winds, the storms, the light and the darkness, the heat and the cold, the air with all its currents and gases above, and the earth will all its fluids and treasures below, all together and alike conspire and co-operate to fertilize the soil."

Thær's theory that the equivalents taken from the soil in the form of crops, must in some manner be returned to the soil again, to preserve its normal fertility, was but the searching out of another of those great principles enfolded within the volume of Nature's laws. It was a denial of the theory of Tull, which presupposes an inexhaustible supply in the soil, requiring only the intervention of those equivalents, returned by excessive cultivation. "Carrion crows bewail the dead sheep, and then eat them." Thaer's theory bewailed the exhaustion by successive croppings;

because the results of life that had been taken from the soil were not restored again, yet could find a healthful nourishment in a supply of humus only, and for a time it was considered as an incontrovertible fact, that the increase or decrease of crops was entirely dependent upon the amount of this material. So afflicted became Thaer with "humus on the brain," that in 1806 he did not estimate bone-dust of any value as a manure, only in proportion to its percentage of gelatin. Even as late as 1830, Sprengel thought bone-dust useless in Germany. Says Stockhardt, "The farmer is quite correct in attributing an especially beneficial influence upon the growth of plants; he must not, however, suppose that this enrichment of the land in humus can be achieved only by directly introducing into the ground in large quantities, such substances (for example, straw manure) as have especially the power to produce humus. This end can be attained, and frequently with greater pecuniary advantage, by a judicious application of guano, bone-dust, etc." Great anxiety on the part of the farmer respecting the supply of humus is uncalled for, from the fact that, Nature herself provides against its removal from the soil when the farmer takes care that it produces an abundant crop of plants. To say the least, Thaer's deductions were irreconcilable with his theory; for all subsequent experience has proved, and continues to prove that all the elements of vegetable structure removed year after year must be returned, or the plants will cease to thrive.

All so-called science is a lie when men throw the facts connected with it out of their legitimate relations to make ideals. The analysis of the soil is a lie when it is regarded as the great disideratum, the "one thing needful," to be able to take a spadeful of earth, and separate the several ingredients of earth, alkalies, salts and gases of which it is composed; to tell to a nicety the per cent. of lime, potash, soda, magnesia, etc.; to figure up, and figure out the exact quantities of lime required to grow a crop of wheat, or of potash for a field of potatoes; to know if the different kinds required for the different kinds of plants are contained in the soil; and if not, what to supply; that the farmer as readily as he could select the sheep from the swine, could say, this field needs lime, and that salt; this needs phosphate, and that nitrogen.

When De Sausure first made known the fact that plants would not grow unless they found in the soil their own proper ash constituents, it was claimed as the greatest triumph of agricultural

science. Men had lived in the belief that, the knowledge of the individual constituents was in no respect important, because vegetables possessed the power of converting lime into silica, or silica into lime, just as one or the other might be needed. When De Sausure and other experimenters had shown this belief to be erroneous, the opposite extreme was run into. Plants must needs be analyzed and their demands upon the soil made known; the soils must be analyzed and what they lacked made apparent; the manure must be analyzed so that what was deficient might be added. The theory looked well on paper, but did not pay as it promised. The truth proved to be that, chemical analysis can give, but rarely, a correct standard by which to measure the fertility of different soils, because the substances therein contained, to be really available and effective, must have a certain form and condition which analysis reveals but imperfectly. The analysis of some Vermont soil that yields only meagre crops of buckwheat, gave the same ingredients as the analysis of the soil from Scioto Valley, Ohio, which produced corn abundantly without manure, simply because there were certain conditions involved which analysis did not determine. A soil may abound in all the elements of a fertile one, and yet be barren. The soil of the great Colorado desert in California possesses the elements necessary to high fertility. Yet the theory has more than the semblance of truth. The mistakes and disappointments are chargeable to those who have thrown the facts connected with it out of their legitimate relations. The error was, that chemical analysis in its infancy attempted to fathom a man's labor ere it had reached man's estate.

Another theory which lays its ban on all schemes of improvement which itself does not originate, is the so-called "mineral theory." Some of the most celebrated agricultural chemists of the day at one time held all other theories as unsound, and that on the abundant or scanty supply of inorganic foods depended the fertility or sterility of a soil—that the great care of the farmer need not be to increase the fertility, but to prevent exhaustion.

Says Liebig, "the true art of the farmer consists in rightly discriminating the means which must be applied to make the nutritive elements in his field effective. He must take the greatest care that the physical condition of his ground be such as to permit the smallest rootlets to search those places where nutriment is found." May it not be justly inferred that the opinions of men

seem to be inherited like some inveterate disease, when the same writer lays down as a principle, "that the real fertility of a soil is always exactly proportionate to the amount which it contains of mineral constituents." It is explained only when it is remembered that "ideals are the world's masters;" for if chemical analysis has revealed anything, has it not revealed that nine-tenths, at least, of every plant is composed and built up of combustible or atmospheric elements, to obtain which, the soil may have been a medium but not a source, and while the theory that every element of mineral plant-food must be present to insure fertility is true enough, does it follow as a sequence that a soil is fertile because these mineral elements are present? Why those barren hill-tops of the West which contain the same mineral elements as the fertile prairies below? The prairies contain humus says Thaer, the hill-tops do not. If Thaer is right, then Liebig is wrong. Both are riding a horse that throws them. "The very essence of truth," says Milton, "is the plainness and brightness; the darkness and crookedness is our own."

Another matter about which much breath and ink have been spent, is the so-called "Nitrogen theory," and such is the earnestness of the disputants that we fear that the advocates of either aspect of the question seldom admit that their opponents are the friends or promoters of science. After long discussion, of forging and hammering, the question is still agitated. Which is the anvil and which is the hammer, may be seen; but which is to win, or whether both, experience must determine. Says Timothy Titcomb, "if the victory were always with the hammer the French would always be victorious; but the anvil won at Waterloo."

Liebig in this discussion, in his work on "The Natural Laws of Husbandry," says "preconceived ideas will for a time assert their sway, and such is the case with those notions which ascribe to nitrogen a preeminent importance in the cultivation of land." "No one," he goes on to say, "who has an acquaintance with chemistry, has the smallest doubt or uncertainty respecting the origin of nitrogen in the arable land. It is derived either from the air, rain or dew, decayed acumulations," &c. In another place he says, "it is the ammonia of the atmosphere that furnishes nitrogen to plants." Boussingault an agricultural chemist of great celebrity, in his "Rural Economy" advocates the free use of ammonia as a manure, and values manures in proportion to the amount of ammonia in them.

Dr. Stockhardt, in his "Field Lectures," one of the most useful works of that distinguished chemist says, "from the circumstance that plants do not take up the nitrogen of the air as nourishment, we infer their inability to do so. This article must beyond all question, be considered the most valuable element in all substances employed as manure."

Prof. Horsford, a former pupil of Liebig gives the amount of nitrogen in a single fertile acre as being sometimes from 3000 to 8000 pounds and then triumphantly inquires what farmer would ever cart from his manure yard 8000 pounds of ammonia to his fields?

Copeland in his "Country Life" replies, "that the tables of analysis have shown that in a single fertile acre there may be 145,605 pounds of lime, 54,251 pounds of potash, 17,289 pounds of phosphoric acid." What farmer would ever think of carting such quantities of these salts out of his yards to his land?

The last item from the budget of modern theories that we shall mention is, that sea dressing and artificial fertilizers exhaust rather than supply strength to the soil.

Says a correspondent of the *N. Y. Turf, Field and Farm*, "too much of Long Island has been drained of its substance by deceiving it with artificial manures, which release the vegetable and mineral matter in the earth, so as to gradually impoverish the soil. Nicoll Neck has been made a receptacle for weeds by constant cropping, aided by sea-weed and artificial manures, which has brought that portion of the Island to the last extreme of poverty, and it will cost more than it is worth to bring it back to its primitive state."

Says a Spanish proverb, "drink no water without looking into it." Say we, accept no theory that may fall and bury us in the debris of its own improbabilities. The assertion that "artificial manures exhaust rather than fertilize," affords more scope for expansion and discussion than the already extended limits of this paper can entertain. It is suggestive of a discussion of what is plant-food, of what is furnished by the soil, of what is supplied by manure, of what *is* manure, of how manures benefit the soil and build up the plant, and, indeed, of the whole question of the application of chemistry to agriculture, a consummation *not* to be wished for. Yet a word here may not be out of place. If we accept as the definition of *manure*, that which our Secretary gives in his late paper on the "chemistry of manures," viz., "any

material used for the purpose and with the effect of accelerating vegetation, or by increasing the production of cultivated plants," it would be hard to prove that such manure, whether specific or general, natural or artificial, would *exhaust* land, or make it poorer. The writer of such nonsense should learn, as his first lesson, that it is never manure added to land which exhausts it, but the crops which he takes from it. If the crops have been larger by reason of manures of an ammoniacal character, it shows that these were proper and suitable at the time. It does not at all show that the same would continue to be suitable and proper; and when barrenness follows large crops got by means of ammoniacal manures, the inference is, that something else is needed for manure, and very likely a good deal of the same ash constituents which were carried off in the crops.

According to a report by Professor Way of the Royal Agricultural Society of England, estimating corn at 50 bushels to the acre, oats 48 bushels, wheat 28 bushels, a crop of each will remove from an acre annually as follows:

	CORN.	STALK.	CORN AND STALK.
Of Phosphoric acid,	21.2 lbs.	10.2 lbs.	31.4 lbs.
" Sulphuric acid,	—— "	6.5 "	6.5 "
" Lime,	0.2 "	13.5 "	13 5 "
" Potash,	11.2 "	43.5 "	56.6 "
	WHEAT.	STRAW.	WHEAT AND STRAW.
Of Phosphoric acid,	15.2 lbs.	4.8 lbs.	20.0 lbs.
" Sulphuric acid,	—— "	—— "	—— "
" Lime,	—— "	13.5 "	—— "
" Potash,	9.0 "	14.0 "	23.0 "
	OATS.	STRAW.	OATS AND STRAW.
Of Phosphoric acid,	7.1 lbs.	8.7 lbs.	15.8 lbs.
" Sulphuric acid,	0 6 "	2.7 "	3.3 "
" Lime,	3.8 "	13.7 "	17 5 "
" Potash,	9.2 "	27.3 "	36 5 "

In one ton of hay, of phosphoric acid 18.6 lbs., sulphuric acid 7 lbs., lime 18 2, potash 99.4 lbs.

An examination of the above table will show that farm yard manure, which has been called the sheet anchor of farmers, may vary widely from a perfect or complete fertilizer. For it will be admitted that manure contains only the elements of the materials of which it is composed; hence from a crop of wheat where only the straw is returned to the farm, there is a loss per acre of 15.2 lbs. of phosphoric acid, and 9 lbs. of potash; of oats, a loss of 7.1 lbs. of phosphoric acid, of lime 3.8 lbs., of potash 9.2 lbs.,

which loss is repeated year after year until the soil ceases to yield remunerative crops, unless some of those auxiliary substances suggested by chemistry are applied. And the longer this depleting process has been permitted, the more extensively useful are those specific adjuncts.

The supposition that artificial can supplant natural manures, is simply absurd. Those who have substituted most, have erred most. No less in error are those who rely wholly upon natural manure, for such as are ordinarily used, contain but sparingly such elements as are not usually found in the soil. Says one who is good authority, "as long as the farm has not reached the highest point of cultivation, every means must be pronounced acceptable, which puts the farmer in a position to provide his fields with more liberal dressing than he is able to give from his own supply of home-produced natural manure."

The great error of the unscientific farmer is, that when the assumption of a theory has been proved false, he is apt to confound true science with false theory, and denounce both alike, instead of winnowing out the absurdity and folly, and gratefully accepting the truths. In each ideal or theory of the past, has been embodied the highest conceptions of the age of a perfect agriculture; one as prescriptive as another, and alike protesting against innovations, which must come of necessity, if there be any genuine development and progress of that aggregate of sciences, the science of agriculture. Then if agriculture *is* a progressive science, there is, and there can be, no standard ideal good for ages. As our own comes up to the point of anything like a just ideal, so will that ideal change its relations to many of the *great facts* and practices of agriculture as they are now understood.

To farmers of our own time is committed the responsibility of appreciating the labor of those who successfully investigate nature and discover new truths of practical value; but that responsibility is maintained, not so much in pressing forward the arena of theoretical conflict, as in holding ground already won, strengthening and improving their position on every occasion.

A writer in the Scottish *Journal of Agriculture*, in an article headed "Orthodox Manuring," well says, "as matters at present stand with the farmer, it is only by a liberal supply of manure to land properly kept in heart, that he can expect to rear remunerative crops. He must work and he must weed—he must plow and

he must plant, stir, roll and harrow, but unless he put in the manure, he may not be able to calculate on a due reward for his labor. The soil itself soon informs against us, if we seek to abuse it—clover will fail to appear in clover fields, and corn refuse to grow in corn soils, and nature will take immediate revenge for an outrage by some slow but certain access of sterility, not to be warded off by theories, however plausible."

SAMUEL WASSON, *Hancock Co.*

Mr. Dike presented the following report on

The Relationship of the Industrial College to the Common Schools.

"By what practical method, if any, can an effective and useful connection between the Industrial College and common schools be effected?"

Looking at this question more carefully and deliberately, I have been induced to present some thoughts on the distinctive characteristics of the different institutions of education among us, and their relationship to each other, and the part they may each be made to subserve in the great work of the education of our people, the whole people of the State.

These remarks will perhaps be thought to be more theoretical than practical; and the question suggests some practical connection; but I hope they may conduce in some small degree to unite the friends of education ultimately in establishing and maintaining a practical as well as theoretical relationship between these two most important institutions of popular education, the common school, and the Agricultural and Industrial College.

At a late discussion before the Board of Agriculture in Massachusetts, when the Industrial College was under consideration, Prof. Agassiz asked a nearly similar question to the one before us, viz.: "the relation in which the college in Massachusetts would stand to the common school system." No one seemed to apprehend the point of his question, at least with sufficient grasp to attempt an answer to it, and Prof. Agassiz himself is reported to have spoken on the subject as follows:

"The point I wish to reach is to have the large number of people who are now interested in agricultural, scientific, commercial and military education, who are now scattered, pull together a little more than they do. My question was with reference to the possibility of contriving some way by which the efforts

of the friends of these various educational institutions, which are now organized in different parts of this State and throughout the country, may be combined, so that they shall help each other. In the Scientific School at Cambridge we are just as much at a loss to know what we should do as you probably are in reference to the future when your pupils shall be increased: Our means are entirely insufficient, and I suppose yours are entirely insufficient, and I think the time has come when we should make it known to the community how in this age,—which is an age in which all education is changing, in which scholastic and monastic education is vanishing, in which even literary education is waning, to make room for more practical, for more active, for more scientific instruction,—I say, I think the time has come when we should make it known to the community how they are to move in that direction. I hold that even our common school education, admirable as it is, tends too much to book learning—just as much to much as our colleges do. The cry against mere book learning in the colleges is already loud enough, but it should not reach the college only; it should reach the common schools also, because there is a great deal of study of things that might be introduced there. If the children of all the common schools could be taught to recognize and know by sight all the stones upon which they tread; if they could be taught to know by sight all the plants and animals which are found in their neighborhood, they would come better prepared to your agricultural school than they do, and they would be equally better prepared to come to our scientific school in Cambridge, or to go anywhere. The foundation would be laid of a better preparation for that practical training which our age demands. I think that agricultural colleges will have somewhat the effect to lead in that direction; and we should, I think, from all sides, press upon the community the need of learning in the direction in which the wants of the active community go, not merely in the direction in which an antiquated practice has led us thus far. I would not lessen in any way the value of scholarly culture. I would not disgrace my mother—and letters have been my mother; I would not disgrace culture in ancient lore even, impractical as it is; but I think in the methods by which these things are taught there are savings to be made in time, which could be applied to things far more useful. When our boys give so many hours to the study of Greek and Latin grammar, I think that that is practically useless, because they could learn a great deal more Greek

and Latin, and Greek and Latin in a way which would last better, even, with less of that kind of teaching; and a little more natural history, and a little more of foreign modern languages, would certainly be a very useful substitute. I think that there lies the need of co-operation between all these institutions which have sprung up to meet wants in a direction which schools and colleges, as they have been thus far, have not supplied."

From this report of the remarks of Prof. Agassiz, it will be seen that he desires to see the various educational institutions of his State combine together in the exercise of their power and influence, as well as to have the various subjects taught, and the methods of instruction practiced at these institutions more practical in their character. These certainly are worthy objects of desire, and what the true friends of education everywhere must desire to see realized.

Our system of common schools is designed to educate the children of the State in the elementary branches of study. This amount of education is free to all, Where good High schools can be established, education can be carried somewhat farther with a limited number. But good and well-conducted High schools can flourish only in cities or larger villages. In the more sparsely populated portions of the States, the advantages of popular education are small beyond instruction in the elementary branches of a common school education. Our colleges, which have come down to us from a remote age, are more specially suited to provide an education for those who contemplate entering one of the learned professions. The ancient languages and mathematics, constitute the principal studies. It is true that the classical college is the rich legacy of past generations. It is not the out birth of a single generation, but the joint product of numerous college systems; it is the result of the efforts of the best thinkers and educators in all highly civilized lands, experimenting more than five hundred years, rectifying mistakes, rejecting errors, thus slowly accumulating the wealth of ages of research and investigation. The classical college of to-day is very different from the college of one of the earlier centuries of our era, with its load of Latin and limited mathematics, its astrology and alchemy. Still, the college of to-day bears the marks of a more monastic and scholastic age, and one far less practical, than the age in which we are now living. As Prof. Agassiz says: "we live in an age in which all education is changing, in which monastic and

scholastic education is vanishing, in which even literary education is waning, to make room for more practical, more active, more scientific education."

Prof. Agassiz has given a hint at one way in which much time may be saved in acquiring a classical education. He says: "When boys give so much time to the study of Greek and Latin Grammar, I think that is practically useless." Language is one thing, grammar is another. One of the most unpractical of all ways of studying a language, is that of devoting month after month to the study of the grammar. That witty remark of Heine contains also a severe rebuke on the late method of teaching Latin and Greek, in which he says, "How fortunate the Romans were, that they hadn't to learn Latin Grammar; because if they had done so, they never would have had time to conquer the world." Montague long ago told us how much easier it is to learn Latin with very little grammar, when we make use of the language in speaking and writing. And Roger Ascham, Preceptor to Elizabeth, gave us good hints on the study of language.

In mathematics, too, the best method of studying this most important branch of study, has not yet been reached. Mathematical truths are to apt to be substantially committed to memory by the student, not incorporated into his understanding and thoughts. They then remain in his mind but a short time, having exerted little if any influence in really educating his powers and faculties. In some cases the student falls into the opposite extreme, and devotes himself so entirely to mathematics that his very thoughts and turns of mind are all mathematical. He thinks in abstract formulas, and becomes useless except for abstruse calculations. Laplace was such a man. When Napoleon employed him as a minister, he found that he could only transact the business of his office in reference to its differential and integral calculus.

But however well the college course of studies is taught, it is better suited to the preparation of young men for the so-called learned professions, than for the more active business of life. It is now a pretty well settled conviction of the best and most prominent educational men of the day, that the old classical and mathematical course of our colleges, does not meet the wants and demands of by any means all, who desire to become educated men. Our colleges are therefore discussing changes or actually making them. At Cambridge the studies are, to a certain extent,

optional with the student, after the first year. The great and rapid advancement of the natural sciences and useful arts, has also led to the establishment of scientific schools. These schools are designed to instruct and train young men to become civil engineers, mining overseers, chemists, geologists, naturalists, architects, &c.; for the age now demands a large body of men to be as well educated as the doctor, the lawyer or clergyman. One of the earliest, if not the earliest school of this character, was founded by the noble-minded Hon. Samuel Van Ransellaer, at Troy, N. Y., about the year 1824. I have from one of its graduates an interesting account of this school. The school was at first established for the purpose of preparing lecturers to go about the State and instruct principally by lectures, the teachers as well as pupils of the public schools, and the people generally in those branches of science which have relation to agriculture and mechanic arts. The Institution was not liberally endowed, and received very little help; but continued a very useful school, devoted to its original purpose, till the year 1849. At that time the name and purpose were changed to a considerable extent, making it a school specially adapted to the preparation of young men to become civil engineers. Its peculiar methods of instruction were continued till 1856, and to some extent till the present time. The lecture system was applied to nearly all subjects of study, and was pursued in the following manner: From twelve to one o'clock a lecture was delivered, of which the students took full notes. At eight o'clock the next morning, the students assembled in the lecture room and were requested to ask questions till all points of the previous lecture were cleared up. This continued about three-quarters of an hour. The Professor then assumed that the pupils could answer any questions he could ask, and he spent the next hour in questioning them. Then the class separated into sections of six, each section taking a room by itself, and being under the general management of one of its members for the day. Then each member delivered the lecture in turn to the other five, who criticised the manner and matter. The Professor was engaged in passing from one room to another, criticising and giving instruction. These section exercises continued till about half-past eleven, from which time till twelve the Professor was putting on the blackboard of the lecture room the syllabus of the next lecture, with diagrams, formulas, &c. These the students copied, and were ready to attend the lecture at

twelve o'clock. The afternoon was spent at the students' rooms, writing out the lecture of the previous day, and the evening, in studying the lecture of the day, and consulting works of reference. A lecture course continued generally a fortnight with one subject. Three days after it was finished, the whole course of written lectures was handed to the Professor for examination. After a lecture course, field work or surveying, astronomical observations, or drawing occupied a week, when another course was commenced. As a rule, the students were occupied with but one subject at a time.

There were examinations consisting of calling a student out from the class, assigning a subject, giving him time to put what was necessary for illustration on the board, and he was then to deliver a lecture five minutes long, on the subject; after which he was questioned by the examining committee. Before these examinations, which continued a week, a day was devoted to each subject for a test exercise, which consisted of an examination by the Professor in the particular department. This was counted of more consequence by the students than the public examination.

Daily records were kept of the standing of each student; and each week the class was arranged in the order of success shown by the records to that time. From these daily records, and the results of the test exercise, a student's standing for the year was determined, and if it did not reach the required limit, he was not allowed to go on with the class; he must go over the course again, or leave. The class of 1856 commenced with sixty students, was reduced to twenty-seven the second year, and graduated fifteen.

The Ranselaer Polytechnic Institution, at Troy, has been one of the most useful and best scientific schools in the country and is still a flourishing Institution. It has led forth prominent, able and educated men into the world; opened honorable and useful careers for numbers who had not the time or taste for the old college course. And I have no doubt, scientific schools will increase in numbers, efficiency and usefulness, for they are the outbirth of this new age. And yet the scientific school is truly only one agency in educating a limited number, chiefly for some scientific profession.

Notwithstanding the increasing number of colleges and scientific schools, the question is still a pertinent one, "what shall be done to give a better education to the thousands of young men

in our State—the sons of farmers, mechanics, and day laborers?" Congress has indicated the first step to be taken in this work, in providing for the establishment of agricultural colleges or industrial schools in every State in the Union, where young men are to obtain a liberal and practical education. The agricultural college is to take the same class of pupils which fill our common schools, and instruct them still farther in the various branches of useful knowledge. It is not like the college and scientific school, designed to educate persons *out* of their present positions, and make professional men of them, even professional agriculturists, but to educate them *in* their positions and enable them to become wiser, better and happier men. The agricultural college, then, if it subserve these purposes, is not to be an institution where the rich, powerful and influential alone may go, but one where all may enjoy its privileges alike—where the pupils meet together on the common ground of equality, work together, live together, and together are trained for the active labors of future life. It is to provide for all, a practical education, because a vast majority of its pupils are to be practical men, and get as good and thorough an education as possible, that it may lift the whole community up, into a condition where each member of his community shall have greater means of usefulness, more sources of happiness, and be able to discharge better all the duties of a good citizen.

The common schools have ever been the boast of New England. They still furnish our whole population better means of education than any other section of the country or portion of the world. But the age is changing. Science is so rapidly developing that the young men of the future need more education, and a mental training more varied and complete, so as to prepare them for the wider and higher fields of usefulness which are opening, and give them the command of more elevated sources of happiness. And the institutions we need to do this work, are of a similar character, only so to speak, of a higher grade than our common schools. In them, education must be just as free to all, and so far as possible, accessible. And it must be within the means of all to attain it. The institution must not inculcate in its instructions, by precept or example, or in its influences, the idea that labor is servile or degrading; on the other hand it must exalt labor to its true place. It must inculcate this truth by precept and example. Its president, professors, and pupils must not be above work. They should all be men of labor in the true sense of the word.

They must not assume that because they are educated, therefore they must not work, but rather show that they are being so well educated as to be able to work more wisely, more efficiently, and more profitably. If our agricultural college is going to inculcate the idea or exert an influence against labor—healthy work, it better never be established in Maine. It would be an injury rather than a benefit to our State. If our farmers and mechanics suppose that they are going to send their sons to the agricultural college to have them educated so that they will no longer need to work for their living, better that they keep them at their own homes, where they learn to be useful if they do not attain so much knowledge. For we cannot live in this cold climate and on this hard soil without labor. When once we have abandoned the idea of work, we must leave these fields and valleys for some sunnier clime. The cultivated lands of the Penobscot, Kennebec, Androscoggin and Saco, must revert to the primitive forests. To establish an institution that would thus militate against the true interests of our State, never could have been the purpose of those wise men who formed the act of Congress.

I think the general character of this Institution has been plainly pointed out: for it is to "promote the liberal and practical education of the industrial classes." That education alone can be said to be practical, which enables men to work better and more efficiently for having had it in their several vocations in life. The practical knowledge of any truth is such a knowledge of it as will enable us to put it into practice; to work it out in the lowest, ultimate form in which it exists in this matter-of-fact world. The mechanic has attained a practical knowledge of the truths of his profession, when he has so learned them as to have become a more skillful mechanic. The farmer attains a practical knowledge of the truths of agricultural sciences when he so applies them as to conduct his farm in a better and more profitable manner. A practical education is what we all want and what our agricultural college must furnish the young men of our State, if it ever lives in the affections of the people.

Education has been defined to be teaching what it is important for men to know, and disciplining the mind; or so much of what it is important for men to know as they can acquire within the limited time given us in this world to get an education, and at the same time to discipline the mind as much as possible. All knowl-

edge is valuable—there is not any knowledge of any sort of truth that is not worth knowing. But as we can take in only a little from the vast treasury, it becomes a question of serious importance, what sort of knowledge we will have taught in our public institutions which are for the benefit of the whole people.

We live in a world of things, not of names, technicalities or words. The first few years of a child's life, it is true, are employed in learning both words and things, but by far the most of the time is spent in studying the nature and character of the things that meet him on every side, in the world into which he has been ushered. We may well suppose that here is a wise hint, which we may follow, in establishing institutions and places for education. We should teach language, the use of words, but the chief part of the instruction should be common things. It is well of course to know the names of the heart, lungs, liver, &c., of the human system, but it is a great deal more important to know where these organs are seated, the functions they subserve in the animal economy, their uses, offices, &c., than to know their technical names.

But if languages be taught, the question arises, to what extent shall they go? Shall only the English language be taught? Shall the modern European languages be taught? Shall the ancient languages be taught? These are all studies of importance. And yet it is well to bear in mind that the ancient Greeks, whose language has been held up in all ages as a model for felicity of expression, knew no language but their own. The Latins knew the Greek and the Latin, but knew neither half so well as the Greeks knew their language.

Now the course of studies we assign to our students, depends of course on what we wish to make men; but if we wish to make them fit for the business of life, we shall not require them to spend much time on Latin, or Greek, or even modern languages, except in special cases.

But our noble English language, with literature unparalleled in the world, we may study, more than it is yet studied in any of the higher institutions in our State. Our great classical authors—we may read Chaucer, Spencer, and the entire classics—the great dramatists and writers of the reign of Elizabeth and Charles—and our great American writers. Here is an ample field spread out before us.

And yet when we think of the enormous quantity of things that

are worth knowing to the world, and well worth knowing, we cannot afford to spend too much time on language, literature, the names, technicalities of science, &c. The boundless fields of nature, the natural sciences are now daily opening up to us, till we are lost amid the immensity of knowledge; chemistry expanding a new world before us, while geology is calling the old world again into existence and enabling us to read its wonderful lessons; and all those other studies, which are the glory and distinction of the time in which we live; these are the studies to which the chief portion of the time of our young men need to be devoted. These are what are engaging the most active and best portion of the world. These are the studies that are looming up higher and higher, every day above the horizon; while the old branches of study, which have so long been pursued at our colleges and institutions of learning, are receding farther and farther into the past. It is scarcely too much to say that at the present time, a man who has usually been accounted well educated, has really but just begun his education. He has been spending his previous years in the mere by-paths of knowledge, and now he must begin to educate himself.

But not only should the studies pursued at our agricultural college be of a practical character, but they should be taught in a practical manner. The instructor should teach by the observation of facts and things, as well as by the statements of theories and of books. The laws of nature should be studied in the facts of nature and by natural objects. Instructor and pupils should together go out into the fields, and study in the open world of nature, and observe and touch the actual things which are the subjects of instruction—the rocks, the soils, the animals, the plants, the fruits and crops, the machines and implements of culture.

It has been asked, in favor of the study of the classics, in preference to the natural sciences, why the pupil may not be as much benefited by knowing the name of Aristides and Socrates, of Cato and Brutus, as by learning to call a certain shell-fish no longer a clam, but a *Mya arenaria?* This is certainly putting the question in a form which, at first light, appears very favorable to the study of the ancient languages. But it is worth while to inquire whether putting the question in this form is quite fair; whether learning to call a certain shell-fish by the name of *Mya arenaria* is studying natural history; whether learning the techni-

cal name of the clam is studying its natural history in any broad and true sense. To my mind, there are other facts about this humble shell-fish, more interesting than learning its technical name, facts which are deeply interesting, facts which suggest interesting trains of thought and inquiry.

For instance, the clam lives in a little house of stony hardness, of just the right size and shape, and in every respect suited exactly to its wants. What is this house made of? Where did the clam find the materials out of which to make its house? How came those materials where it finds them? How does it know how to build them into a house?

The little gelatinous speck, floating in the water at its birth, has through some means, obtained one or two ounces of a hard material, in a short time, suitable for its house. It had no means of hammering it out of the limestone cliffs, and quite likely there are no calcareous deposits near its home. It has absorbed or drawn the material for its house from the waters in which it moves. How immense the beds of shell-fish on the shores of the ocean. What a vast concentration of lime once held in solution in the sea, is effected by these puny creatures, and others related to them.

What an interesting field of inquiry is opened by these facts about this little clam! Why the surface of the globe has been altered and modified, in ancient and modern times, by the silent labor of the multitude of these little creatures engaged in the productions of calcareous matter. The whole peninsula of Florida has been manufactured out of sea water (or the substances held in solution in the sea) by the little polyps. Our marble houses, tombstones, mantle-pieces, &c., are the result of their labors. The marble is made up of the relics of these animals. If they are not visible to the eye, the microscope shows them. It is probable that nearly, if not quite all limestone rock, is of animal origin and produced from the water of the sea.

One can scarcely allude to any fact in natural science, so dry and uninteresting, as that of the Latin, technical name of an animal or plant. If the study of the natural sciences is made to consist in knowing the mere Latin technical names of the animals, plants, minerals, &c., about which instruction is given, as has been too much the case in the schools and colleges; then it makes but little difference whether we study languages, literature, history or natural science. For in either case it is the study of mere words, names and technicalities. But the study of botany or

zoology is not learning the Latin name by which the genera and species of plants and animals are known in the books. These sciences open fields of far higher and wider range; they lead directly to the study of the works of Him who made the world, and the laws He has put into operation, and the wonderful wisdom He exhibited everywhere around us; and no christian mind can be a sincere student of the works of God, in any department or field of science, without being brought nearer to God, and to know more of him and to love him better for his wisdom and goodness.

If then the studies at our Agricultural College are what they should be, and taught in a practical manner, we must seek to bring the privileges of the institution within the reach of all so far as possible. We must open wide the doors of the college, not only make it accessible, but inviting, and conduct it with such rigid economy that it will be within the means of the poorest. This institution will then bear a resemblance of and relation to the great system of common schools in our State. It will be as free as they are; it will furnish the means to every boy in Maine of prosecuting his education to such an extent as to become a well educated man. It will be, by and by, I trust, the crowning part of the great system of common schools, established so wisely among us, for the common good, the common welfare of us all. It will be the State's own institution, established and conducted exclusively for the benefit of the young men, all the young men of the State. And more and more of these young men will accept the privileges of the college, as the common people are made to realize the benefits of such an institution.

S. F. DIKE.

A discussion followed the reading of the report, in which Mr. Goodale said:

I have listened with much pleasure to the reading of the report, and particularly to that portion where allusion is made to the change which is going on in education; from what Prof. Agassiz so aptly terms the 'monastic and scholastic' method, which has come down to us from the dark ages, modified little by little, as it has been compelled to yield to the universal demand for more general education, and for more practical education.

When the act was passed, establishing the State College of Agriculture and the Mechanic Arts, I felt that a most important

step had been taken in the right direction—a step which placed Maine in advance of any of her sister States. I felt so because that organic act distinctly shadowed forth an institution quite unlike the 'monastic and scholastic' institutions hitherto known among us as colleges; and indeed unlike (and in my opinion better than) any which had been undertaken by other States under the act of Congress providing for the 'liberal and practical education of the industrial classes.' These last, so far as I am advised, have been either the ancient monastic article with additional modern improvements, (after the manner of new cloth patches upon old garments,) or else they are just scientific schools—nothing more and nothing less. Now no one values these more highly than I do, for the purposes which they were intended to subserve; and these were the training and education of civil engineers, mining engineers, professional chemists, architects, and such like; but they never were intended for the training and education of such young men as propose to be, and to continue to be during life, either farmers, working their own lands, or mechanics, using their own tools. I say that scientific schools were never intended for the 'liberal and practical education of the industrial classes;' they are not adapted to such an end; as a matter of fact they have done no such thing; they never undertook anything of the sort; never promised to do it, and there is no pretence that they have done it.

The act passed by the Legislature of the State of Maine did contemplate (in the language of the act of Congress bestowing lands for their endowment) the 'liberal and practical education of the industrial classes;' but the time and attention of the original Board of Trustees was mainly given to the question of location. For long months this was the all absorbing topic. At length a decision was reached, viz.: to locate at Topsham, from which place liberal proposals had been made; and where there existed, as I then believed and still believe, a most remarkable combination of natural advantages.

Subsequently, proposals came from Orono, and it was strongly urged that the question of location should be re-opened. The chief argument used was that the majority which decided the question lacked one of a majority of the whole Board (not all being present.) Somehow or other, the question was opened, and if my recollection is not at fault, without a majority to that effect; and shortly thereafter it was again decided, and this time to go to

Orono. In that vote several participated who had been elected to fill vacancies only a few days previously, and who had not visited either place. When a suggestion was made to one of these that a few day's delay, spent in personal investigation of the comparative advantages of the the several locations, would do no harm—it being then midwinter—he was understood to respond, that he had all the knowledge which he desired on the subject; and that man's vote turned the scale—so far as it turned at all—for the decision was once more made by a bare majority of those present, and by less than a majority of all the trustees. The arguments so strennously urged a little while before, at once lost all force and pertinency! The vision of grievous wrong inflicted upon the industrial classes in Maine by such a transaction, as suddenly faded from view!

The former Board, at no time did more than make a beginning towards carrying into effect the provisions of the organic act. I am not sure that they did much beyond deciding one question preliminary to that beginning. It may be doubted if up to their last day there existed any adequate maturity of thought regarding the ways and methods of actually embodying the principles set forth in that organic act.

It was supposed that the incoming Board of Trustees would make it their first business to reach satisfactory conclusions in this regard. Before a tailor cuts a coat he takes the measure of his customer. Even the bee, the beaver and the bird, before they begin construction, have as definite ideas of the life to be led in their several structures, as they have after they move into them—and so they avoid costly blunders; and man, if he has not the instinct of the lower animals, is the possessor of far nobler powers.

There is good authority for the belief that it is poor policy to put new wine into old bottles; and if an educational institution is to be put into practical operation, so widely unlike the scholastic institutions which we have been accustomed hitherto to call colleges, as is the institution contemplated by the act of the Legislature of Maine, it is fair to presume that its requirements in the way of structures and furnishings, would be unlike also.

We may well believe that the new Board would require time to consider thoughtfully the problems involved in the very important trust which they had assumed. These problems were both novel and profound; their solution demanded most careful deliberation

and great practical wisdom. Was it too much to expect that, before commencing to build, they would come to satisfactory conclusions, and at the proper time would present them to the public? Indulging such an expectation, I have examined with great interest the document lately placed on our tables—the Annual Report of the Trustees of the State College of Agriculture and the Mechanic Arts, and so far as I am advised tho only document issued by the Board, hoping to find those conclusions clearly set forth therein. I am disappointed. There is in it mention of lumber and bricks, of Durham heifers, and underdraining, of hay and barley and beans, and manure, but of education, not one word; and of educational plans, methods and means, not much. I do not say there is no clue to their thought, for I read as follows: 'A part of the Board believed that plain, brick buildings after the old college plan, capable of accommodating either forty-eight or sixty-four students, according to the height, really the most economical. Two such buildings, or at most three, together with a building for the laboratory and lecture room, might accommodate all the students, and in the infancy of the institution, some of the rooms might be used for general purposes. Those in favor of such buildings believed that the materials or style of architecture made use of in building, would not necessarily determine either the course of study to be pursued or the industrial character of the institution.' From this I infer that entire harmony of views had not been attained; also, that by some, old bottles were considered cheaper than new; and that the character of the bottle would not necessarily determine the use to which it might be put. Perhaps a farther clue may be found in the following sentence: 'The dormitory building is now progressing towards completion,' &c. This word 'dormitory,' I have not been accustomed to find often used except in connection with a scholastic college, or a convent, or something else of monastic origin.

And now, Mr. President, with these prefatory remarks, offered with a view to state my ignorance and the scope of the inquiry I would make, I respectfully ask the member from Sagadahoc, who is also a member of the Board of Trustees, to furnish the industrial classes of Maine, through this Board, with such additional light as he may be able to do, upon certain matters of importance not clearly shown in the published report, and in which the farmers and mechanics of the State are most deeply interested.

Mr. DIKE responded as follows: I rise to say a few words, in answer to my friend from York. He asks me to 'furnish such additional light on certain matters of importance, not clearly shown in the published report, as I may be able;' referring, of course, as I understand him, to the vital question of the character of the institution we would build up at Orono. At the time when the report was read over for the approval of the Board of Trustees, I regretted that this question had not been discussed to some extent, at least in this first document issued by the Board; but it was then too late to make much addition, for this was the last meeting of the Board for the year 1867. After some reflection on the matter, I determined to prepare a paper on the subject and present it to this Board. This I have done, and the paper is now before you. It was written at a late day, and is not so full and complete as I could wish. It may, perhaps, convey some idea of my own views of what the future character of our agricultural college should be; what the character of the education it shall furnish, and the method of instruction there to be practiced. I know not whether these views are in accordance with those of the other members of the Board, or not. I do not know whether they have any definite views, or have given much attention to this subject. The question which the gentleman from York alludes to, has been very little discussed thus far, at any of the meetings of the Board; and I presume this is the reason that the report throws no light on the character of the agricultural college—at least throws no light on the important points to which the gentleman refers.

The Board then went into informal session, and John F. Anderson, Esq., in answer to a call upon him by Rev. Mr. Dike, spoke as follows:

Messrs. President and members of the Board of Agriculture:—With a profound sense of my own unworthiness, I acknowledge your great courtesy. Had it not been for the remarks of your Secretary upon the report before you, I might have rested with merely an expression of thanks for the singular consideration shown me by your action and invitation, because it is not in me to speak properly to that very able, interesting and suggestive report upon the connection of the State College of Agriculture and Mechanic Arts with our common school system of education, just rendered by my respected friend, who so competently repre-

sents the county of Sagadahoc at this Board. I have not the ability even to criticise or comment upon that paper; much less to add anything to the subject matter of it, or to offer advice thereon of any value whatever. But while I listened to the measured words dropping from the lips of your honored Secretary, I felt that my time and opportunity were indeed before me; and if, in what I am about to say an offensive warmth appears, I crave your charitable indulgence towards one who, unaccustomed to utter his thoughts publicly, has been incited by an honest indignation, to speak from the fulness of his heart, long pent up words.

Mr. President and gentlemen: I feel that I speak to you as a representative farmer of this State, unauthorized to be sure, but nevertheless truly; and the gist of my remarks will lie in these questions: What are the Trustees of the State Industrial College doing for the farmers and mechanics of Maine? what do they propose doing? how do they propose to do it? and when?

Some years ago I had the honor of a place at this Board, as well as a place on the Board of Trustees of the State Agricultural Society; and during that time the donation of land for the fostering of agriculture and the mechanic arts in a collegiate society was granted by the general government to our State. As unworthy President of the two organizations, I was intimately associated with the moving spirits of both—our fatherly friend, the late Dr. Holmes, Secretary of the State Society, and Mr. Goodale, then as now, Secretary of the State Board of Agriculture, besides other honest and disinterested men, prominent among whom were Hon. Samuel F. Perley and Thomas S. Lang, Esq., former Presidents of these organizations. We were associated together in urging this college, which seemed to promise so much for the future of the farmers and mechanics of Maine, into a separate and independent existence. Met at the onset by a formidable array of Presidents and Professors of our scholastic colleges, aided by their hirelings from out as well as inside the State, I, even I, the least of the upright coterie in every respect but honest zeal, was instrumental in bringing to its aid the man of might.

I confess to you that I have been proud of the forethought which prompted me to solicit that learned man, the soundest and most independent and powerful to originate new thoughts among them all—Hon. Phinehas Barnes—into standing forth as the champion of the weak against the strong; of the unlettered poor

against the learned rich; of the farmers and mechanics against the Professors and Divines, who, with their corporation Presidents and lawyers were banded together, and for more than two years tried to seize this little possession of ours and divide it among them. Not to lose sight of figures of speech repeated in the hall above by one of these scholastic teachers, our champion uncovered 'the cat which lay hidden in the tub of meal,' and swinging into light the 'axe brought here to grind,' struck them back in confusion. But, gentlemen, I have lost that pride, because I fear that our possession is coming to naught. I was a spectator of the act which, by a majority of one vote or fraction of a vote, consigned this intended State institution to the obscurity of a merely local pile of bricks and mortar, against the solid vote of those men whom you and I, and all the honest farmers and mechanics of Maine recognized then, and still recognize as the portion of that first Board of Trustees of this College of Agriculture and Mechanic Arts, who were sincere and disinterested in their regard for its future.

When the Topsham farm, shown to be incomparably better for the purpose in all respects, and located at the very centre of railroad communication with all parts of the State, and near the seaboard also, was under consideration and by a similar vote accepted, the disinterested friends of the college, who then solidly voted yea, were asked by the other party to be magnanimous, and deem it, for the time, an informal vote. But there was no corresponding offer of magnanimity when these true friends were voted down, and the college was consigned to Orono by a majority vote of one-half of one.

Well, these gentlemen got their college located at Orono. What then did they do? First the President of the Board of Trustees resigned within half an hour of the record of that vote. The location settled in accordance with his behests against the convictions of its true friends, the master spirit of the movement retired from all responsibility and visible direction in its management. Then what was done for a year, a little more or a little less, no matter for a day or two when nothing was accomplished. What did they? As near as I can learn they first employed the landscape engineer Olmstead, of New York, to project a plan of their island farm, bought a pair of horses and—retired, leaving their elephant, about whose sustainment they could devise no ways and means, chained to a stub. Having taken the time

named to ascertain that they did not compose the proper body to manage him there, that Board gave it up and resigned.

Another was appointed, and what have they done with the elephant? what do they propose doing? Well, let us look at this their first report. First let us see who compose the Board. Here are the men—President, Abner Coburn of Skowhegan, ex-Governor of Maine, well known all over the State as one of our ablest business men, one who has built up for himself a colossal fortune, and controls the material destiny of an army of laboring men. Trustee, George P. Sewall of Oldtown, eminent as a lawyer, politician and farmer, with brains enough to stock a Legislature, as has been repeatedly demonstrated to his fellow citizens throughout the State. Trustee, N. Wilson of Orono, another lawyer of experience in legal and legislative practices. Trustee, W. P. Wingate of Bangor, formerly Collector of that port, a man of note, accustomed to the management of grave affairs. Trustee, Lyndon Oak of Garland, a tried and faithful legislator, the careful scrutinizer of every enactment, who thus won the implicit confidence of his constituents and all others. Trustee, Samuel F. Dike of Bath, our reverend and respected friend, who has shown us in this report of his, so plainly, what we never questioned—his ability, learned attainments, sagacity, and above all, honest and zealous labor for a future of something besides the bricks and mortar pointed out by your Secretary.

Now for their report. I shall not weary you with it, for 'tis not so long but we can run through it quickly, and it is so clearly printed and withal so simple, that he who runs may read and understand. It begins with mention of Mr. Olmstead's plan of the general location, size and use of the buildings, as an act of courtesy to that eminent man and the preceding Board who employed him. Then of repairs to the Frost and White houses. Then, we are informed, that for knowledge of what should be built, they called to their assistance two practical mechanics of Bangor, and Mr. Stead, an architect of Portland; and because this Portland architect was driven to some weeks' delay in cudgelling his brains to the extraordinary labor of devising what in his opinion, might be the vital principle, the inner and essential constituent, the vivifying soul of their college, and then to design the proper clothing for his precious device, upon him is publicly cast the odium of greatly increased cost over what was estimated. During Stead's delay, we learn that the drouth of summer came

the river ran low, and lumber ran up so that an increase of two or three dollars per thousand for about one hundred thousand, increased the cost of the building several thousands of dollars. We have a hint however, that men from Orono and Bangor were 'hired by the day, and were more expensive than if the work had been done by contract.' Then the report gives an account of the brickyard, in nine lines; then of the farm, in six lines; then the crops, the orchard, the stock; then of thoroughbred Durhams, of swine, inventories of property and estimates for the coming year; then the signature of the President, and this is all of it—and with the Treasurer's report annexed. Now I submit whether all you who have thought so well of these Trustees, and have felt you had reason to expect something from them, I ask all men who have sought for and read this report, are you not disappointed? I declare I am.

We had a right to expect in a report from the Trustees of this State College some glimpse of the vital essence which was to shape its future. If the report had contained the paper presented here by the member from Sagadahoc, we should have recognized a soul in that body and a promise of an earnest future life which would have given us a hope. But when the official report of the Trustees presents only a poor body, leaving it for one of them in another capacity as a member of this Board, to present here its soul, we feel as if the two were sundered, and that while we have here the soul without a body, they have down there the body without a soul.

The member from Sagadahoc seemed to hesitate and to be at some loss when he rose to the call made upon him by your Secretary. If he could have given in reply facts which would have redounded to the credit of his associates, do any of us who know him believe he would not have answered with his customary promptness? While he was thus hesitating, that part of the Governor's message occurred to my mind, which informed us that he could not induce, or found it difficult to induce gentlemen most naturally suggested, to accept the position of Trustees. I hoped he might ask back whether he whom the entire people of the State regarded as the proper man to be upon that Board was invited to such position, and if he, as we all believe he must, answer yes, then why did he not accept the trust?

Mr. Scamman remarked:—This matter relating to the Agricultural College, now in the incipient stages of its establisment

is one of vast importance, inasmuch as it can be made to subserve the highest good of all our industrial interests, if properly managed. And the paper just read by the gentleman from Sagadahoc, sets forth in clear and distinct terms how this can be effected, and it is an assurance, so far as he is concerned at least, that his utmost efforts will be put forth to secure the desired end.

By the politeness of a friend in Bangor last August, I enjoyed the privilege of a visit to the farm and grounds selected as the site for this Institution, and although the farm is in many respects a good one, and affords some desirable facilities, yet, it looks as though a mistake had been made in its location. How or by what means this has been accomplished, I do not propose to inquire. Enough has been shown to satisfy us that certain influences have been at work that should have been left out of an enterprise so truly looking to the good of our industrial welfare.

Fitness for the particular business or work to be accomplished, has been too often overlooked, or ignored or given away to party purposes in projecting and prosecuting our public enterprises. If we wished to employ a man on our farms, we should not ask him if he had studied Greek or Latin, or was versed in the fine arts, but are you a practical farmer? Do you know how to do all kinds of farm work? So then if the State wishes to erect a public building, or prosecute the Hydrographic survey of the State, or establish a college to aid its agricultural interests, the same rule would prompt us to employ a practical mechanic, or a practical engineer, or men of such broad practical views as would secure the end in view.

Without saying more on the general subject, I wish to call particular attention to the idea advanced by the gentleman of making labor honorable. This is a point of great importance. If you can establish the institution on a basis that will correct the false impressions now prevalent, that labor is menial, degrading, one great point will be attained. When you combine labor with instruction, so as to make one a relief to the other, you develope both the mental and physical systems, while you are impressing upon the pupil that to be able to show by actual application the theories and abstract truths derived from books, is a part of education, and an honorable part. Too many of our young men look upon farm labor as drudgery, and seek some other employment where there is less show of work than on the farm. Now let the projectors and managers of the Agricultural College give promi-

nence and character to labor, to daily labor. Let the boy that is not ashamed to work with his hands, be looked upon and respected as much, to say the least, as the boy who will only study. Give prominence to intelligent labor everywhere. Let every student feel that he has accomplished only one-half of his task, until he can not only tell what kind of manures, and what kind of treatment is necessary for a given crop, but be able himself to do the work. I repeat then, that any course that will raise labor to the dignity its importance demands, is a step, and a very important step, in the right direction.

Mr. Carpenter spoke as follows: *Mr. President:*—In what I have to say at this time on the subject before the Board, it is not my intention or desire to give an opinion as to whether the former Board of Trustees performed their part in the best possible manner, or that the present Board have done their duty, or as to their qualifications for the position they have accepted. If we are to judge from the report of their doings just published, I will say for one I am disappointed. I wish to endorse the report now under discussion made by the member from Sagadahoc on the relationship of the Industrial College to our common schools. We desire to bring the Industrial College and the common school together, nearer than they are at the present time, both by improving the college and the schools, so that our boys when they leave the schools can have the benefit and advantages of the college. Efforts should be made to prepare the pupils both in the common schools and all our colleges, for the business of life; to apply the knowledge so gained to all our affairs, to all kinds of labor. It adds to the capacity of labor, makes it more productive, and gives it a more cheerful aspect. Formerly, if one contemplated a college course, he also looked to one of the learned professions (as they are called.) These persons have an advantage over their fellow men above those less favored. Knowledge is power, and when rightly applied it becomes a mercy and a great benefit to mankind, but when wrongfully used it proves a curse. I desire especially to call attention to that portion of the report which refers to the great amount of time expended in a college course in the study of Greek, Latin, and the higher mathematics. The position is taken I believe, that much valuable time is thus wasted, and the information gained is worthless. I will allow those who have been there to be the best judges of this matter. If they admit it to be correct I see no reason why we who have not been

there should dispute it. They ought to know, and as far as I am able to judge of its practical advantages I am inclined to think they are correct. What I desire most of all is, that in the course marked out for the Industrial College all the studies that after a trial of hundreds of years are found to do little or no good will be left out, and those introduced that we have good grounds for belief will prove to be of the greatest practical benefit to mankind. 'That labor may look up here and rejoice in the midst of its toil.'

Mr. Wasson said: *Mr. President:*—The farmers and other friends of the Agricultural College have been watching its progress with a great deal of interest. They have feared that it would be subverted to the base end of a political machine on which, or with which the axes of scheming and designing men were to be ground. Those fears have been somewhat excited, when as appears by the Governor's Address, 'it was found difficult to induce gentlemen most naturally suggested' to accept the appointment of Trustees. It would be a relief to our suspicions did we know that that *difficulty* was not what many have surmised, or what has been hinted. If an appointment is coupled with political services, or if eligibility is to be measured from a partizan stand-point, then may the friends of an Agricultural College despair of ever seeing one in operation in Maine.

I confess to but little confidence in any good which is to come from that so-called Agricultural School. It was so unfortunate in its infancy as to fall not into the hands of good 'Samaritans.' It started wrong, and its managers seem not to be aware of the fact. Yet, sir, in view of all these facts, we still hope better counsels may prevail, that practical farmers may not only be induced, but may be permitted to have a voice and influence in its management.

Wheat Culture.

Mr. Goodale offered the following for adoption;

Voted, "That the several county agricultural societies be and the same are hereby required to offer during the current year, a sum in premiums on wheat culture equal at least to one-third of the amount of the State bounty received during the year."

Mr. G. remarked that action like this was legitimately within the province of the Board. The Legislature seems unwilling to offer any bounty, and it seemed to him that there was need either

of some temporary stimulus being applied, or some method being adopted which shall direct public attention more strongly to the needs and capabilities of the State in the matter of bread-stuff. We pay out very large sums for what, in his opinion, to considerable extent, we might produce to advantage at home.

Mr. Dike thought the proposed action of questionable expediency. He had grown wheat for many years with indifferent success, and had come to the conclusion it was not profitable to raise it. His soil was a stiff clay and probably could be better fitted for wheat by under-draining. He thought the general soil of Maine was not well adapted to wheat growing, and believed the indications of past experience showed we could do better by raising other crops that could be grown to better advantage and exchanging them for wheat. We should raise those crops the soil and climate are best adapted to, for they are certainly the most profitable crops.

Mr. Putnam said that in Aroostook county the average yield per acre the past season, was about twenty bushels of good quality. He had known of fifty-four bushels of wheat to the acre being grown. More than double the amount of wheat was sown the past year than has been sown heretofore, and if it is put in early enough to avoid the midge, good crops are almost invariably secured. If the land is very rich so that the straw is apt to lodge, an application of about three barrels of unleached ashes are needed to the acre.

Mr. Carpenter formerly raised winter wheat with very good results, and believed it poor policy in any farmer to dispose of the raw materials of his farm whatever they might be, and his aim should be as far as possible, to raise all he consumed. He thought its culture should be maintained, even if it was not what would be called a paying crop. One farmer in his town raised good wheat every year, at the rate of about twenty-four bushels to the acre.

Mr. Ayer spoke of the impetus given to wheat culture under the State bounty of 1840, and for many years after the bounty was taken off it was continued with good results until the advent of the midge discouraged farmers from growing it. Farmers in his section considered it very essential to lime the soil for a crop of wheat, and if proper exertions were again made by farmers he believed the results would be satisfactory if not surprising.

Mr. Wasson spoke of the great importance of wheat culture to

our State, and thought it one which every member of the Board should be ready to offer some facts and suggestions upon. Can wheat be raised in Maine, or must our farmers make dependance to always procure it from beyond our borders? But a few years ago wheat was raised in great quantities in Maine, and even now our soil, our climate and other conditions are all favorable to its growth. The difficulty as to its cultivation he believed to be purely an imaginary one. He believed it was not an exhaustive crop. Every year the distance of the wheat growing sections of our country is becoming farther and farther from us, and in the same ratio the cost of transportation is also increasing. So much so that many of our citizens find it a hard matter to procure this necessary article, and he feared it would not be many years before our people must be obliged to grow it in our own locality or substitute something else for its use. He believed that to-day the average yield of wheat in Maine was larger than that of any other section of New England, and indeed, of some sections formerly 'called the wheat growing sections of the Middle States. Let the farmers of Maine be made to believe they can grow their own bread, and in less than five years they will do it. But to accomplish this, one thing is needed, our land must be put in better condition.

Alluding to the statement of Mr. Dike that farmers should raise some other crop in exchange for our wheat, Mr. Wasson said "that all other crops grown in our State, whether sold or consumed, would not pay for the flour brought into the State. Our shipping, our lumbering, our fisheries and other commercial pursuits pay for the wheat consumed. We must grow our own wheat in the future or abandon the State. But wheat can be grown, and it must be. We must give less attention to other pursuits and devote more time to real farming and the production of bread. The land must be made rich, and the seed must be put in early. These are the two prime requisites of success in wheat culture."

Mr. Chamberlain of Piscataquis, said that last year the average yield per acre has been from nine to fifteen bushels, but in some instances in very favorable locations double this amount has been obtained. There is no more labor in raising a crop of wheat than a crop of oats, and the former pays double what the latter does. It succeeds best on old mowing fields, with an application of ten loads of manure to the acre, applied upon the surface.

Mr. Hobbs of Knox, had raised from fifteen to twenty bushels of wheat from one bushel of sowing, applying the seed at the rate of one and a half bushels to the acre.

Mr. Brown of Lincoln, said that in his county, winter wheat was more generally sown than spring grain, and the average was about eighteen bushels to the acre, the kernel plump and handsome. Wheat is generally sown upon land previously occupied by potatoes, the soil usually clayey.

Mr. Stackpole of Penobscot, remarked that winter wheat was little sown in the county, and the spring wheat was last year nearly a failure, not averaging more than ten bushels to the acre. In some years previous the average had reached eighteen to twenty bushels. He inquired if an application of lime was necessary to raise wheat.

Messrs. L. Chamberlain and Dike replied to this query showing that the lime formations were the real wheat growing regions. The latter gentleman supposed the object of a bounty on wheat was to induce farmers to increase its culture, but as soon as the bounty was withheld its culture stopped. This he thought showed that our farmers considered wheat raising an unprofitable pursuit, and he regarded the statement of the gentlemen from Hancock as to the cost of the wheat brought into the State, as conclusive evidence in the same direction.

Mr. Prince of Androscoggin believed that with an average of only ten bushels to the acre, wheat growing would pay better than the growing of any other grain crop; but the ravages of the midge had brought about its neglect by the farmers.

The discussion was continued at an informal session, in which several not members participated.

Mr. Poor of Andover, said that previous to the appearance of the midge in 1835 good crops were easily grown. By 1837 the midge was abundant, and the culture of wheat was too generally abandoned. He had found this by preparing the land in the fall and sowing quite early, good crops can still be obtained.

Mr. Jefferds had raised wheat in Piscataquis for many years, and with an average of from nine to eighteen bushels to the acre. He had in one instance raised twenty-four bushels to the acre. He had practiced sowing lime with his wheat, in the proportion of one cask of unslaked lime to two acres of wheat, using a part of it at seeding, and a part after the wheat was up. He hoped the action and suggestions of the Board upon this matter, would

be such as would induce farmers to engage more largely in its culture.

Mr. Moore of Somerset, alluded to the culture of wheat in the early settlement of the county, when immense crops were raised, and said that until the advent of the midge it was regarded as a sure crop. During the past few years, our farmers have become aware that the midge is disappearing, and good crops are now obtained. Upon the high lands in his county, from eighteen to thirty bushels are obtained, even where the crop is sown after corn, and with no extra application of manure. He believed the subject a most important one, and one that should be brought to the earnest attention of all farmers throughout the State.

Mr. Fish of Somerset, a former member of the Board, said that for thirty years he had not failed to raise a crop of wheat, except in one year. In one instance during the past year, a farmer in his town had a field of four acres, of which a very large proportion was smutty. It was the only instance of smutty wheat in town for thirty years. The wheat crop with him, has been a very good one, and taking the average of the past thirty years, has amounted to sixteen to eighteen bushels to the acre. Generally sows after corn. Had sometimes sown after potatoes, but had not obtained so good a yield as after corn. His usual practice was to break up sward land, manure and plant to corn and potatoes, and then sow to wheat and seed down. On under-drained land he had received a very heavy yield.

After some discussion as to the local bearings of the proposed action in different sections, the vote was amended by substituting "one fourth" in place of "one third," and in this amended form was passed unanimously.

Trials of Speed.

Mr. Goodale introduced the following:

Resolved, That this Board recommend to the several county agricultural societies that, in future, trials of the speed of horses be conducted one by one, and not by competition with one another.

Resolved, That this Board recommend that the sums offered by county societies for trials of speed of horses should not exceed the sums offered for the culture of breadstuffs.

Mr. Goodale remarked that he introduced this subject chiefly in order to get an expression of opinion whether what he considered

the undue prominence given to the trotting of horses could be lessened without crippling the agricultural societies in a pecuniary point of view. He thought the man who had a fast horse had as good a right to exhibit that quality in his horse, as one who had a fine sheep had to exhibit the character of its wool, because speed is an element of value in a horse; still there could be no question but the prominence given to trials of speed of horses at our agricultural exhibitions in the few years past had been productive of evil. The carrying out of the first of the above resolutions might perhaps do away with much of this difficulty.

Mr. Carpenter thought it would be hard work for our societies to get along without trials of speed in competition with one another. They draw a crowd and place the societies on a good financial basis.

Mr. Prince believed that without the horse trot accompaniment at our fairs we should get up but meagre shows. He did not know that they did any good, and was not sure that they did any hurt.

Mr. L. Chamberlain spoke of the management of the agricultural societies in his county, and said there were two sides to this question of horse trotting. In their society they could not get along without it, but as soon as he was shown a better way to get along and take the place of it, he would be ready to adopt it.

Mr. Wilder remarked that he was no horse-man, but did not see how, in the management of our societies, we could get along without trials of speed at our fairs, for he believed horse-men were as entitled to show the speed of their animals, as others were to show the good qualities of their animals, or articles of a different nature. He admitted it to be objectionable but could hardly see how we could get along without it, much as it was to be desired.

Mr. Ayer would like to see the resolutions adopted by the Board. Croakers we would have, let the matter remain as it was or be changed. Some men will find fault, let the management of societies be what it may, and we could diminish some of the evils by compelling the trials to be made separately.

Mr. Wasson remarked that the question of horse-trotting in his county had for years been a troublesome one. He presented some figures in regard to the receipts of the Hancock Society, which showed that for the first day of the exhibition in 1866, the receipts were $30; the second day, $125; and the third day—the day of trials of speed of horses—$850. In 1867, the receipts were for

the first day, $127; the second day, $433; and the third day $435—the trotting being divided between the two last days. In his county the society could not live a year without the receipts obtained from this source. The plan of agricultural discussions in various towns in the county—under the auspices of the society—had been attempted and proved of wonderful efficacy in creating an interest in the society and contributing greatly to the success of the annual fairs.

Mr. Scamman believed the subject of trotting horses at Fairs had received an undue prominence, but he still believed it to be as legitimate a business as for a man to show the strength of an ox. The great difficulty was to keep it under proper control, and he thought there might be some way in which it could be done.

Mr. Moore thought if his society should be prohibited from offering premiums for speed of horses, it could be sustained but a very little time.

Mr. Putnam remarked that should the plan recommended in the first resolution be put in operation, it would take several days for his society to hold their exhibition, as the horse interest in his county (Aroostook) was an important one, and many horses of different classes were examined which took a great deal of time.

After some farther remarks the resolutions were indefinitely postponed.

Change of Climate.

At one of the informal meetings the following topic was the subject of discussion:

"Has any considerable change taken place in our climate in the last fifty years; and if so, to what cause or causes is it to be attributed? What are the evidences?"

Mr. Stackpole said he had lived in Penobscot county thirty-five years, and he had noticed as the land became cleared the streams produced a much less volume of water. When he first moved into the county there were several mills in the village that could run six or eight months in the year. Now they lie idle most of the time, with the exception of the grist-mill. The snow storms were not so severe as twenty or twenty-five years ago, and he had noticed of late years, that in the West there were heavy snow storms when ours here are light. The present winter, so far, had been a very cold one. During thirteen days in December the mercury was down to and below zero, while in the same month in 1866 it

was down to or below zero only seven times. In 1866 the lowest temperature was seven degrees, and this year, thus far twenty-seven degrees. He thought the forests in his section had diminished in extent, one-half during the last fifteen years, a part of which was due to heavy and destructive fires in the forests. Fire wood is now becoming an object, and it is hauled fifteen miles to market. Fifteen years ago the soft, seasoned growth was worth but a trifle, and now it is worth $4 per thousand for shingles and staves.

Mr. Wasson said: We have no forests in Hancock county. The growth of small, light wood we have is rapidly disappearing and the stave mills and hoop manufacturers are cutting off all that is growing, and if this work goes on for a few years to come to the extent it has in those that are past it will be but few years before we shall have no pine, no spruce, no birch and no poplar. Many families in the town in which I reside—Surry—have not a single stick of wood growing upon their farms, and large numbers have been dependent for years for their fuel, upon the drift wood that comes down Union river. The change of climate in our section is for the worse. There are occasionally seen by the sites of some of the older dwellings, apple trees of great age and size, but in late years it is impossible for newly set apple trees to be made to live more than six or seven years. The springs that were years ago regarded as living springs have in late years dried up and failed completely. The storms of snow you have in this section of the State, are usually rain with us on the coast, and we have but little snow during the winters generally. The change in our climate is very marked. We have now no spring as formerly. April and May seem crowded into June, and October is crowded back into September. Our section also suffers greatly from drouths, and for the last four years—preceding the last—we have raised hardly any crops for want of rain.

Mr. Wilder remarked that during the past thirty years he had observed a marked change in the seasons in his section. Thirty years ago his county—Washington—was largely covered with forest. Thirty-eight years ago the iron works in Pembroke were started, and an overshot wheel was put in to carry their machinery. Some six or eight years ago this wheel was taken out, there not being water enough to carry it, and during a part of each summer the works have remained idle for want of water. During the past twelve or fifteen years the water in the river has been growing less

and less every year, and there is now not three-fourths the volume of water in the river there was thirty years ago, and the clearing up of the land had undoubtedly caused more of the rain to evaporate. Many of the trout streams of twenty-five and even twenty years ago were now completely dry. A stream ran across his farm that did not now have more than one-half or two-thirds the water in it, that it did twenty-eight years ago. He believed there were not so many snow storms in the winter as formerly, but on the contrary, there were more thaws and more rains. The soil, he thought, did not produce so well as twenty or twenty-five years ago. He spoke of the importance of our forests, and thought farmers paid too little attention to the raising of a growth of wood. Every farmer should set off a part of his farm to grow up to wood. Sheep and cattle should be kept out from an acre or two of pasturing, that the hard wood growth might live, as it was known that cattle and sheep would feed off all hard wood growth in pastures, and soon unless they were kept out from a portion of the pastures, no growth but a black or soft growth would appear.

Mr. L. Chamberlain said that in his section, Piscataquis county, corn was planted in 1830, in April, but since then it had not been planted so early by about two weeks. The trout streams of twenty years ago were now nearly dry, and he believed there was not two-thirds the water in Piscataquis river there was twenty or thirty years since. In 1840, two feet of snow fell on the 2d of November, but of late years our first snows did not fall until about the last of December. He thought the seasons shorter now than twenty years ago, and the springs were colder and shorter. The corn crop in his section is a safe one, and some kinds ripen in ninety days. There is now less snow in winter, less rain in summer and more rain in winter than formerly.

Mr. Dunning of Charleston, of the House of Representatives, regarded the change in the seasons during the past fifty years as a very marked one, as there was now fewer blocking storms in winter, and less rain in summer, than at that time. He also believed the weather was not so cold, and that the winters were warmer. It was true old people were apt to think the summers not so warm as years ago, for as they take less exercise than formerly, they feel the effects of the sun's heat much less. He said there was often a difference of several degrees of temperature within four or five miles, and the locality or other circumstances must have some influence upon it. Thirty or forty years ago the

corn crop was very uncertain ; now it is regarded as one of the surest crops grown. This fact led him to believe there was a marked changed in the character of the seasons.

Hon. Dennis Moore of Anson, remarked that about forty-two years ago, when the Dead River settlement in Somerset county was being opened, the first settlers could raise nothing but wheat and oats, and never attempted to plant corn. In Anson, from 1812 to 1830, corn was regarded as an uncertain crop, but it has not been injured by early frosts in the last twenty-five years. The snow storms we have now are not so heavy as those of twenty-five years ago. As to the drying up of streams by the clearing of land, he believed that streams having their heads in low, wet lands would be dried up somewhat in a few years by the process, but thought it could not be true of those streams rising in highland springs and among mountains.

Mr. Putnam of Aroostook, said he moved into that county in 1831, and at that time corn was planted but little, and wheat, if sown late, was often killed by the frost. The county was subject to very early frosts at that time. In 1831 he planted a little corn the 2d of June, and it was nearly all destroyed by frost August 18th. The greatest expectation he entertained in regard to growing corn when he first went into the county, was that he could get it fit to eat green—as boiled and roasted. Now corn is regarded as almost a sure crop if planted early, and it does not fail oftener than once in eight or ten years. It is usually planted from the 15th to the 20th of May. In consequence of the clearing up of the forests there was not so much rain as there was thirty years ago. Neither were the snows as deep for the ten or twelve years last past, as for the same number of years before that period. Thought the thermometer usually did not go so low as it did thirty years ago. The county did not, as a general thing suffer from drouth, and he believed that should the forests be cleared for twenty years to come to the extent they had for twenty years past, there would still be no injury from drouth. The past season, which in many parts of the State was unusually wet, was not so in his county. He thought there was not so much water in the streams as formerly, and that the changes in temperature were more sudden. He did not remember that the thermometer had ranged so low for thirty years, as during the past season.

Mr. Holmes said that he had resided in Kennebec county thirty years, and in Oxford county,—his present residence—thirty

years. He believed in late years the seasons were shorter and colder, especially in spring. There was less time to get in seed. In 1816 corn was killed by frost in Kennebec county, but with this exception the crop has usually ripened. He thought the county of Oxford more subject to early frosts than the county of Kennebec."

Lecture by Mr. Chamberlain.

By request, Mr. Calvin Chamberlain repeated before the Board a lecture, prepared for and first delivered before the Library Association of Dover and Foxcroft, a few weeks previously. The thanks of the Board were voted to Mr. Chamberlain, and a copy requested for publication; which was furnished; as follows:

It has been announced that one among you—usually a silent individual—will lecture on

"Man a Destructive Power."

Any subject of much less moment than an error of his, wide-spread as civilization—a mistake as broad and deep as humanity itself—a subject of universal interest, to which every intelligent mind cannot too soon devote earnest thought—would have failed to tempt me to assume a position so opposite to my habit and taste.

I propose to speak of man as a destroyer, avoiding the well explored fields of his geological and theological status. The present train of thought is not affected by the inquiry whether man has existed on this planet six or sixty thousand years. The diligent student may go on reading human foot prints in the old volume of nature, and examining facts as they are recorded in books,—which he usually finds outside of small, carefully selected libraries—touching this interesting inquiry. With his conclusions we have nothing to do. Neither shall I wander, in the present hour into the mazy fields of fact and fiction touching man's mental obliquity, the ways and means by and through which he is to be rejuvenated and his existence perpetuated.

If life is a blessing, if the laws governing our existence here are beneficent, if we are placed here to exercise our faculties in providing physical comforts for ourselves and our successors, then it becomes a duty to so treat mother earth that she may be able to bestow like favors on future man till the laws governing planetary worlds shall be repealed.

The leading pursuit of civilized man is agriculture. Of necessity it fixes his habitation. From permanent homes naturally come social order, laws, love of country, record of history, the accumulations of progress, durable architecture, mental growth, nationality. No roving race built the stupendous monuments that outlive all history and tradition.

But as we read man's history in his footprints, we see on every hand that his ways and methods of deriving his sustenance from the fields of his occupancy are not compensating ones. Every crop taken from the soil diminishes its capacity to produce another. The necessary elements and conditions of vegetation must be replaced, or the day of exhaustion will surely come—a day of ruin and desolation. It is a precept enjoined on agriculture, that whatever is taken from the soil by the harvest must be returned to it again. The violation of this precept inflicts an injury upon a country and does injustice to the race—tends to its extinction, or to force it back to barbarism. To destroy the productiveness of the soil, is to destroy the hopes of civilized humanity, and rob posterity of its just birthright to a career of progress.

What right have we, the transitory tenants of a fair and fertile world, to despoil it of that without which human advancement is impossible, and turn the fair heritage over, sterile and impoverished, to the generations we summon into being? Shall we, the creatures of a day, be held guiltless for our thoughtless waste inflicted on *one* country, in view of the infinitude of ages that this earth has been preparing for the habitation of man!

By intense heat, by icy cold, by lava torrents, and grinding glaciers, by earthquake and volcano, the upheaval of mountains, the ocean's deluge, the river's flood, by the tempest, by the sun's rays through eternity of day and night and the revolving seasons, by the kingdoms of vegetable and animal life, whose multitudes and tribes are extinct, air and water have been purified, the solid rocks have crumbled, the fragments sorted, washed and mingled, the flow and distribution of water fixed, and temperature toned to suit the home of man. Through all mutations the minerals of the harvest have been borne and safely treasured in the fruitful soil. To take this precious dust from the earth and not return it, is to imperil the existence of the race.

My subject unfolds into the inquiry as to the evidences of the effects of man's labors on the physical condition of those portions of the earth's surface where the greatest numbers have had an

existence. In other words, what effect has man's operations on physical conditions?

A few moments spent here in considering what Physical Geography is, and what are some of its lessons, may be profitable to young minds, to the better understanding of what may follow. One compiler in this field of science,* opens his work by defining Physical Geography to be "a description of the general features of the earth's surface, the organized beings placed upon it, and the operations of the atmosphere by which it is universally surrounded. It relates to the earth as it exists in a state of nature, without regard to political or arbitrary divisions, or to any of those changes or improvements in the world which have been effected by man."

The last clause of this definition seems to be a wrong position. I will not object to excluding the "*improvements*," but where the "changes" wrought are of a negative character and of vast magnitude, a mere definition of a science ought not to lend a barrier to their just criticism. Some fields of man's greatest efforts, as indicated by the ruins of his works, are now laid in barren wastes.

How are we now to study such regions as they might be pursented to us, if the harmony of nature had not been disturbed by man? Or if this expression is a seeming "begging the question,"—how are we now to study them as they were when giving sustenance to a thousand times their present population?

Another school of Geographers present the science as "the general phenomana of the present life of the globe;" including the inquiry,—how far external physical conditions have influenced the social life and social progress of man.

"It was a narrow view of geography which confined that science to delineation of terrestrial surface and outline, and to description of the relative position and magnitude of land and water. In its improved form, it embraces not only the globe itself, but the living things which vegetate or move upon it, the varied influences they exert upon each other, the reciprocal action and reaction between them and the earth they inhabit. Even if the end of geographical studies were only to obtain a knowledge of the external forms of the mineral and fluid masses which constitute the globe, it would still be necessary to take into account the element of life;

* George W. Fitch.

for every plant, every animal, is a geographical agency, man a destructive, vegetables, and even wild beasts, restorative powers.

Whenever man has transported a plant from its native habitat to a new soil, he has introduced a new geographical force to act upon it, and this generally at the expense of some indigenous growth which the foreign vegetable has supplanted."

Physical Geography teaches that the earth is surrounded with a transparent and highly elastic fluid, called the atmosphere. It is indispensable to all living creatures. The atmosphere is mainly composed of two gases called oxygen and nitrogen, in the proportion of 21 parts of oxygen to 79 of nitrogen. It usually contains about 14 parts in a thousand of water in the form of vapor. The property of elasticity in the atmosphere admits of its expanding and becoming much lighter by heat. A portion of atmosphere becoming lighter than neighboring portions, rises to a higher region; when the more dense surrounding air rushes in and restores the balance.

The sun's rays always falling directly on the surface of the earth at its central zone, and more obliquely towards the poles, the atmosphere is at all times receiving more heat in one part than in others. Hence atmospheric currents or winds may be formed by the power of the sun's rays alone. The direction and force of the wind is very regular in the central and warmest zone, and is a leading power in the formation and continuance of ocean currents.

The direction of winds on the oceans, is changed, and their force and character disturbed by the continents lying in their course. The atmosphere becomes more heated over land than over water. Ocean currents of large volume, ever moving from warm to colder regions, and the reverse, have a great effect on the temperature and humidity of the adjacent atmosphere. Mountain chains interpose a barrier to winds. These and other secondary influences cause the regularity of the winds in the equatorial regions to disappear by degrees as we advance into the temperate zones, where they sweep in all directions.

Winds carry with them the temperature and the moisture of the places whence they come. A sea breeze highly charged with moisture, passing to a colder region where it becomes condensed, must part with a portion of that moisture, which forms clouds, and falls in rain. Moist winds, when they encounter an elevated obstacle, like a chain of mountains, are forced to ascend their slope into a colder air, where their vapors are condensed, and the

rain flows down their slope. The wind may pass over the mountain, but it arrives on the other side dry and cold. Thus the wind that brings rain on one side of a mountain range, brings fair weather on the other. The quantity of water that falls from the atmosphere in the tropical regions is very great—being estimated on the eastern continent at 77 inches annually, and in America at 115 inches. But some localities, under the influence of certain circumstances, receive much more.

The mean quantity of rain-fall in the temperate zone of the eastern continent is estimated at 34 inches, and temperate America 39 inches. But these fruitful showers are better distributed through the year, than are the more prodigal ones of the tropics; and are more advantageous to vegetable and animal life.

The revolutions of the seasons, the climates of the different zones, and the general condition and movements of the atmosphere and the seas, depend upon laws beyond our control. "The elevation, configuration, and composition of the great masses of terrestrial surface, and the relative extent and distribution of land and water, are determined by geological influences equally remote from our jurisdiction. It would hence seem that the physical adaptation of different portions of the earth to the use and enjoyment of man is a matter so strictly belonging to mightier than human powers, that we can only accept geographical nature as we find her, and be content with such soils and such skies as she spontaneously offers." "But it is certain that man has done much to mould the form of the earth's surface, though it is not always easy to distinguish between the results of his action and the effects of purely geological causes. The destruction of the forests, the drainage of lakes and marshes, and the operations of rural husbandry and industrial art, have tended to produce great changes in the condition of the atmosphere, though we are not able to measure the force of the different elements of disturbance, or to say how far they have been compensated by one another or by still obscure influences; and finally the myriad forms of animal and vegetable life, which covered the earth when man entered upon the theatre of a nature whose harmonies he was destined to derange, have been, through his actions, greatly changed in numerical proportion, sometimes much modified in form and product, and sometimes entirely extirpated."

The physical revolutions wrought by man have not all been destructive to human interests. Northern and central Europe,

since the days of Roman rule, has, under the sway of intelligent industry, vastly improved in its physical condition in many respects, and has attained to a material wealth and variety of product that with all their natural advantages, the granaries of the ancient world hardly enjoyed. While man has improved his physical condition in one direction, the reverse had a constant growth in another.

The man of western Asia, the restless, progressive man, whose "march of empire" has been westward, whose high mission has been to subdue the earth, and subject the elements of nature to his purposes for the ultimate good of his ever increasing numbers, has left his foot prints by the way; and it is our privilege this evening, as the younger members of the family, to look back over these foot prints, and read as best we may, of his successes and his failures. Man seems to have forgotten that the earth was given him for use alone, not for consumption, still less for profligate waste. Nature has provided against the absolute destruction of her elementary matter. But she has left it within the power of man to so far derange the combinations of inorganic matter and of organic life, that practically, in an extended sense, the law becomes a nullity. Before the advent of man, the organic and the inorganic world were bound together by such mutual relations and adaptations as secured the permanence of both, and admitted of very slow and gradual succession of changes in those conditions. "But man is everywhere a disturbing agent. Wherever he plants his foot, the harmonies of nature are turned to discords. The proportions and accommodations which ensured the stability of existing arrangements are overthrown. Indigenous vegetable and animal species are extirpated, and supplanted by others of foreign origin; spontaneous production is forbidden or restricted, and the face of the earth is either laid bare or covered with a new and reluctant growth of vegetable forms, and with alien tribes of animal life.

These intentional changes and substitutions constitute, indeed, great revolutions; but vast as is their magnitude and importance, they are insignificant in comparison with the contingent and unsought results which have flowed from them."

The earth was not, in its natural condition, completely adapted to the use of man, but only to the sustenance of wild animals and wild vegetation. But man, the animals that serve him, the products that supply him, cannot subsist and rise to the full de-

velopment of their higher properties, unless brute and unconscious nature be effectually combatted, and to a degree vanquished by human art. Hence a certain measure of transformation of terrestrial surface, of suppression of natural, and stimulation of artificially modified productivity becomes necessary. This measure man has unfortunately exceeded. "He has felled the forest whose net-work of fibrous roots bound the mould to the rocky skeleton of the earth; but had he allowed here and there a belt of woodland to reproduce itself by spontaneous propagation, most of the mischiefs which his reckless destruction of the natural protection of the soil has occasioned would have been averted. He has broken up the mountain reservoirs, the percolation of whose waters through unseen channels supplied the fountains that refreshed his cattle and fertilized his fields; but he has neglected to maintain the cisterns and the canals of irrigation which a wise antiquity had constructed to neutralize the consequences of its own imprudence. He has stripped the clothing from extensive plains, and has failed to reclothe them with artificially propagated vegetation; thus leaving them a barren waste of drifting sands. He has warred on all the tribes of animated nature whose spoils he could convert to his uses, and he has not protected the birds which prey on the insects most destructive to his own harvests. His destructive agency becomes more and more energetic and unsparing as he advances in civilization, until the impoverishment, with which his exhaustion of the material resources of the soil is threatening him, at last awakens him to the necessity of preserving what is left." Without multiplying charges here, let us return to the foot prints. The progressive man, descending from upper Armenia, becomes a vast multitude upon the arable plains watered by the Euphrates and the Tigris, is organized into a vast empire and spreads a civilization westward, covering the peninsula of Arabia, Syria, Armenia, Asia Minor, Greece, Sicily, Northern Africa, Italy, Spain, and leaving its traces as far north as Switzerland, and Denmark. This wave of civilization was succeeded by one of obliteration, leaving in the East the debris of cities as extensive and grand as Paris and London,—in the West, human remains, mingled with works of art and the bones of extinct races of animals, to interest modern scientific explorers. Onward in the course of time, man's recuperative energy repeopled all the vast area of western Asia, and united it successively in the Assyrian, Babylonian, and Persian empires. Coming thus down

to the historic period of the Caucasian man, we are presented with other evidences touching population and consequently the physical condition of the country. The direct testimony of history to the ancient fertility of these regions, "the multitude and extent of yet remaining architectural ruins, and of decayed works of internal improvement, show that at former epochs a dense population inhabited those now lonely districts. Such a population could have been sustained only by a productiveness of soil of which we at present discover but slender traces." The abundance derived from that fertility alone can explain how large armies, like those of the Persians—in one instance, says the historian, the army, including camp followers, numbered five millions—and of the Crusaders and the Tartars in later ages, could, without an organized commissariat, secure adequate supplies in long marches through territories which, at present, would scarcely afford forage for a single regiment.

It appears that the fairest and most fruitful provinces of the Roman Empire, that portion of terrestrial surface which, at the commencement of the Christian era, "was endowed with the greatest superiority of soil, climate and position, which had been carried to the highest pitch of physical improvement, and which thus combined the natural and artificial conditions best fitting it for the habitation of a dense and highly refined and cultivated population, is now completely exhausted of its fertility, or so diminished in productiveness, as, with the exceptions of a few favored oases that have escaped the general ruin, to be no longer capable of affording sustenance to civilized man." Add to this realm of desolation, the now wasted and solitary soils of Persia and the remoter East, that once fed their millions with milk and honey, and we have a territory larger than all Europe, the abundance of which once sustained a population equal to that of the whole christian world at the present day. All this is withdrawn from human use—thinly inhabited by slender tribes—poor in products—"too little advanced in culture and the social arts to contribute anything to the general moral or material interests of the great commonwealth of man." Thus man through his ceaseless acts of aggression, by the constancy of his outrageous attacks on the fair domain of nature, is at last forced to relax his grasp on her choicest field, and concentrate his forces at another centre, for further operations.

A little removed from the the theatre of his tremendous exploits,

out of the range of the arid winds which circulate from central Africa to northern Asia, more under the influence of the humidity of the Atlantic, on the soil of Europe, which, with long enduring patience of thousands of years, essays to reproduce her vegetable covering as often as it is removed,—here rests for a time the seat of empire. Here taking an advanced stand-point we may overlook the never-ending conflict as it intensifies in interest. The man of the Old World, on his way from the highlands of Asia, as he has descended from station to station, has marked each of his footsteps by a new civilization superior to the preceding, by a greater power of development. Arrived at the Atlantic, he pauses on the shore of an unknown ocean.

In the language of Guyot—"Under the influence of the soil of Europe, so richly organized, he works out slowly the numerous germs wherewith he is endowed. After a long and teeming repose, his faculties are reawakened, he is reanimated. At the close of the fifteenth century, an unaccustomed movement agitates and vexes him from one end of the continent to the other. He has tilled the impoverished soil, and yet the number of his offspring increases. He turns his looks at once towards the east and the west, and sets out in search of new countries. His horizon enlarges; his activity preys upon him; he breaks his bounds."

The discovery of America and the islands of every sea, have served to widen the circle of civilization and the range of improvement. Europe, through a fortunate train of circumstances, now presents the spectacle of a family of States drawn together by material ties and spiritual bonds. Old ideas have become common property; new ideas spread through space almost with the rapidity of thought, and reach the understanding of all. The special gifts of nations all blending together, form a rich organic unity, with a regular and healthy growth, exalting the powers of man to a degree hitherto unknown. While industry, commerce, and agriculture employ the activity of Europe, another feature of her society is *the desire to know*—reflection—science—activity in the intellectual world as well as in the material. The European man treats high philosophical questions, works out a thousand ideas in all the branches of science. "He is the man of ripened age who reflects upon men and things, analyzes the causes, and seeks to understand the lessons of the spectacle the world presents." In the last three centuries, Europeans have given much attention to the subject of physical deterioration. The literature of the

forest, which in England is not yet come to be any considerable branch of authorship, and still less in America, now counts by thousands its volumes in Germany, France, and Italy. Sylviculture has become a distinct science of the schools. Fortunately for our country, we can now avail ourselves, before utter ruin overtakes us, of the knowledge there gained, of the philosophical discussions as well as the presentation of the subject in an economical aspect. Facts collected from observation and record running through several centuries, so far as they reach us in our own language, are intensely interesting and conclusive.*

Thus man "accepts the situation;" but whether he is to become master of it, remains to be seen. At present there are some slight indications that he may. His maturer mentality grasps the perils, and measures the defences of the field of present conflict. He sees and understands the causes of previous disastrous defeats. But he still loses.

Should I here leave this part of my subject—treated in a general way—I might fail to impress you with my own convictions of its

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* As a matter of curiosity, showing the amount of labor and thought expended in this direction, I have collected the captions of books, essays, or chapters, devoted to this subject, to the number of over fifty. To repeat them here may be suggestive of further thought in like channels: Causes of physical decay, are—"a due allowance for geological causes"—"Direct violence of human force"—"The result of man's ignorant disregard of the laws of nature"—"The incidental consequences of war, tyranny, and misrule." "Transfer of vegetable life." "Extirpation of vegetables." "Organic life as a geological and geographical agency." "Domestic animals eminent destructive agents in the garden of nature." "Extirpation of quadrupeds." "Diminution and extirpation of birds destructive to insects." "Introduction of insects." "Destruction of reptiles, such as feed upon insects." "Destruction of fish." "Extirpation of aquatic animals." "The habitable earth originally wooded." "First removal of the woods." "Effects of fire on forest soil." "Effects of the destruction of the forest." "Electrical influence of trees." "Chemical influence of the forest." "Influence of the forest, considered as inorganic matter, on temperature." "Trees as a shelter to grounds to the leeward of them." "Trees as a protection against malaria." "Influence of forests on the humidity of the air and the earth—on temperature and precipitation—on the humidity of the soil." "Its influence on the flow of springs." "General consequences of the destruction of the woods." "Literature and condition of the forest in different countries," "The influence of the forest on inundations." "Destructive action of torrents." "Mountain slides." "Protection against the fall of rocks and avalanches by trees." "Principal causes of the destruction of the forest." "Special causes of the destruction of European woods." "Royal forests and game laws." "Small forest plants." "Utility of the forest." "The forests of Europe." "The economy of the forest." "Sylviculture." "Lands artificially won from the waters." "Exclusion of the sea by diking." "Drainage of lakes and marshes." "Geographical influences of such operations." "Climatic effects of draining lakes and marshes." "Geographical and climatic effects of aqueducts, reservoirs, and canals." "Surface and under-draining, and their climatic and geographical effects." "Subterranean waters." "Artesian wells." "Artificial springs," &c.

vast importance to us. I can make the character and magnitude of the evils in question better understood by presenting in detail some facts of actual occurrence. I have only time to select a few.*

In the southeastern provinces of France—Dauphiny, Avignon, and Province—recent deterioration has been watched by very competent observers. These provinces comprise a territory of fourteen or fifteen thousand square miles, or one half the size of Maine. The surface is generally hilly and mountainous. Here was Roman civilization. Here the orange, lemon, date, the vine, and fig flourished. Later than the Roman rule, the Crusaders brought home from Palestine the knowledge gathered from the wiser Moslems, the art of securing the hillsides, and making them productive by terracing and irrigation. The forests that covered the mountains secured an abundant flow of springs, and the process of clearing the soil went on so slowly that, for centuries, neither the want of timber and fuel, nor the other evils about to be named, were seriously felt. Through the Middle Ages, these provinces were well wooded, and famous for the fertility and abundance, not only of the low grounds, but of the hills. Such was the state of things in the year 1600. The statistics of the next century show an increase of prosperity and population in the lower portion of these provinces, while there is an alarming decrease in the wealth and in the population of Upper Province and Dauphiny, although by the clearing of the forests, a great extent of plow-land and pasturage had been added to the soil before reduced to cultivation. "It was found, in fact, that the augmented violence of the torrents had swept away, or buried in sand and gravel, more land than had been reclaimed by clearing." From official documents is seen, that at dates running through the eighteenth century, one commune, town, or village after another were laid waste and deserted. In 1776, Viscount Puget reported: "The mere asnect of Upper Province is calculated to appal the patriotic magistrate. One sees only lofty mountains, deep vallies, rivers with broad beds and little water, impetuous torrents, which in floods lay waste the cultivated land upon their banks and roll huge rocks along their channels; steep and parched hillsides, the melancholy consequences of indiscriminate clearing; villages whose inhabitants, finding no longer the means of subsistence, are

* The inquirer may find an extended article on this subject in 10th vol. of Maine Agriculture—1865.

emigrating day by day; houses dilapidated to huts, and but a miserable remnant of population." Another administrator of the province writes in 1792, "The washing down of the mountains is to be ascribed to the clearings and the practice of burning them over." During the French Revolution the most of the remaining trees were destroyed, and the desolation before described has since advanced with still swifter steps. Blanqui, spoken of as the eminent political economist, in a memoir read before the Academy of Moral and Political Science, 1843, says: "Important as are the causes of impoverishment already described, they are not to be compared to the consequences which have followed from the two inveterate evils of the Alpine provinces of France, the extension of clearing and the ravages of torrents. The most important result of this destruction is this: that the agricultural capital, or rather the ground itself—which, in a rapidly increasing degree, is swept away by the waters—is totally lost. Signs of unparalled destitution are visible in all the mountain zone, and the solitudes of those districts are assuming an indescribable character of sterility and desolation. The gradual destruction of the woods has, in a thousand localities, annihilated at once the springs and the fuel." It is worthy of special notice, that the district here referred to, though now among the most hopelessly waste in France, was very productive down to so late a period as 1789. Arthur Young, who visited France at that date, says: "About Barcelonette and in the highest parts of the mountains, the hill pastures feed a million sheep, besides large herds of other cattle;" and he adds: "With such a soil, and in such a climate we are not to suppose a country barren because it is mountainous. The vallies I have visited are, in general, beautiful." In 1853, ten years after the date of Blanqui's memoir, M. de Bonville in his report to the government says: "It is certain that the productive mould of the Alps is daily diminishing with fearful rapidity. All our Alps are wholly, or in large proportion, bared of wood." "I will not dwell upon the effects of the torrents. For sixty years they have been too often depicted to require to be further discussed." "An indirect proof of the diminution of the soil is to be found in the depopulation of the country."

Mirabeau estimated the forests of France in 1750 at 42,000,000 acres—about 32 per cent. of the whole country. In 1860 they were reduced to 19,769,000 acres. In a country and a climate where the conservative influences of the forest are so necessary as

in France, trees must cover a large surface and be grouped in large masses, in order to discharge to the best advantage the various functions assigned to them by nature. The consumption of wood is rapidly increasing in that empire; and it is probable that Mirabeau's estimate of the proportion of forests in 1750, was not too great for permanent maintenance. The Germans have estimated the proper proportion of wood land to entire surface at 23 per cent., for the interior of Germany. The due proportion in France would considerably exceed that for the German States, because France has relatively more surface unfit for any growth but that of wood, because the form and geological character of her mountains expose her territory to much injury from torrents, and because at least her southern provinces are more frequently visited both by extreme drouth and by deluging rains. During the period in question, "France neither exported manufactured wood or rough timber, nor derived important collateral advantages of any sort from the destruction of her forests. She is consequently crippled to the extent of the difference between what she actually possesses of wooded surface and what she ought to have retained." "Italy and Spain are bared of trees in a greater degree than France; and even Russia, which we habitually consider as substantially a forest country, is beginning to suffer seriously for want of wood." Every district in Russia deplores the ravages of man or of fire; and clear-sighted men already foresee a crisis which will become terrible. "Hohenstein, who was long professionally employed as a forester in Russia, describes the consequences of the general war upon the woods in that country as already most disastrous, and as threatening still more ruinous evils. The river Volga, the life artery of Russian internal commerce, is drying up from this cause, and the great Muscovite plains are fast advancing to a desolation like that of Persia." In Bavaria and Austria is seen the same improvidence which marks the rural economy of Switzerland, Italy, and France, and the effects are hardly less disastrous. Nearly every island of the seas where European colonies are established for the production of articles which enter into commerce, are reported as suffering materially through causes proceeding from the destruction of woods. The Cape de Verds, some of you will recollect, not many years ago were suffering from famine, and an appeal was made to this country for food. At that time the population was reduced thirty thousand by starvation—one third of the whole. Their forests were destroyed and rain ceased to fall.

There is a partial reverse to this dreary picture. Enlightened individuals in most European States, governments in some, have made extensive plantations of wood. The objects of the restoration are as multifarious as the motives that have led to their destruction, and as the evils which that destruction has occasioned. I have thus tarried as long as time permits, in looking over the course of instruction in the only school with extensive appointments, where we can look for that practical knowledge which shall be a safe guide to us, to a wise administration of the affairs of so important a part of the physical world as is committed to our keeping. We can make an application of the facts there deducible, so far as they apply to these States situated under similar physical conditions. We have noted that rain-fall is about the same here as there. Temperature there at any given point can find its parallel here. Both are open to Arctic winds—unprotected by any high mountain range. The States east of the Mississippi have the warm, humid winds from the Gulf of Mexico, not very unlike the effects of the Atlantic on Europe. In the time remaining to us, I shall only try to consider man's destructive agency on physical nature, so far as it applies to American forests.

Four centuries ago, America lay unworked and solitary, glutted with its vegetable wealth. Its soil waited the hand of man to work out that wealth. The primitive owner was incapable of the work.

The European established himself little by little upon this new land. His footing once secured, the colonies were reinforced and strengthened day by day. This was not a new civilization, but the transfer of one already made. The man of the Old World, whose education had been there completed, appeared here upon a larger theatre—a scene worthy of his activity. Here the different peoples of Europe have met, with room enough to move in, and have mingled their efforts and their gifts. Having measurably exhausted Europe, his first appointed task was to subdue and fashion a savage nature to his pleasure. He has worked out the task with a *firey* activity. The nations of Europe have in the mean time enriched themselves from the products of these forests. Has the task been done wisely? Has not man already overstepped the proper bounds to the domain of nature? or if not, is he not likely to do so in the immediate future? These are important questions, and they seek a speedy solution. The statistics from one decade to another, of the number of farms in these States,

the number of acres added to improved lands, the proportion of improved lands to unimproved in the several States, the amount of marketed lumber of all kinds, the increase of population, the rapid increase of home consumption of wood for the innumerable purposes to which it is applied, all together present a mass of facts, that by their magnitude alone, cannot fail to arrest the attention of every thinker. With these statistics in mind, the observing traveller as he passes from Maine to Kansas, from New Hampshire to Georgia, will prepare himself to listen to almost any one who may take the stand and plead for the trees. Look where you will upon the operations of civilized man, the application of wood to his purposes is on a scale so collossal, that, it seems to me, we cannot lose sight of this grave matter, when the attention is once directed to it.

In our own country the dwellings of twenty-five millions of people are chiefly made of wood; and in the world there may be six hundred millions whe dwell in wooden habitations. When we look at this perishable material, as it enters into the construction of the out-buildings of Americans, and think of its amount, then of the fences of the country, which cost more in material and in labor, than all the buildings on farms, added to that of all the villages and cities, and then take into the account that all this wood is destined to decay and compel renewal in twenty-five years—fix all this in mind, and we have made one point in illustration. The destruction of buildings by fire in these States, is no inconsiderable item in this view of consumption. The evils of past destruction are now experienced in all our cities and large towns, in the great increase of cost of fuel, and in the price of lumber and timber. High rate of fares and freight charges on our lines of travel, result in the main from the increased cost of building steamboats and railroads, and running them. Railroads are enormous consumers of recent introduction. The sixty thousand miles now in use or soon to be completed, demand an almost incalculable amount of wood. With 2500 ties or sleepers to the mile, these roads require one hundred and fifty millions; and these ties decay and require renewal in about five years.

This vast number causes the destruction of a nearly equal number of trees—for a tree generally make but one sleeper. The lumber used in fencing these roads, in building bridges, depots, and cars, is quite an item to be added to former consumption. Then of the fuel! It is estimated that the distance run each day

by trains on all the roads, is 308,000 miles. Each engine with an ordinary train consumes about 1 ¾ cords of wood for every 25 miles. This gives a daily consumption of wood for this purpose alone, of 21,560 cords, or 6½ millions cords annually. Telegraph poles are a recent item in demand for trees. The sixty thousand miles of lines, at forty poles to the mile, is 2,400,000 poles—representing so many trees now recently cut. These also decay rapidly, and soon require renewal. The mechanical industry of the country demands much wood and lumber. About half a million of artizans, enumerated in near a hundred trades or callings, work wholly in wood. The late civil war caused the destruction of much wood. It has been cut for fuel, for fortifications, to hinder the movements of opposing forces, and to open the country for military movements. Sleepers from torn-up railroads, costly bridges and buildings have been burned; and the relaying and rebuilding all these, demands a new supply.

Native Virginians are removing from some of the finest parts of the State, because of the destruction of the timber; and for the same reason, emigrants decline to go there. In their haste to get their land under cultivation, men cut and burn large tracts of magnificent forest, while they could, with great advantage to the crops, and the general health and beauty of the country, leave every field or every farm with a fine belt of timber surrounding it. Much land in Maine and other States has been cleared, which should have remained permanently in wood, by reason of rocks and other obstructions—worth just nothing as cleared land—in locations where the wood, if spared, would have secured a permanent value of one hundred dollars per acre. On every hand the waste of the forest goes on with a constant acceleration of speed. "The cunning foresight of the Yankee seems to desert him when he takes the axe in hand."

When we think of the increase of population, and look forward to the time when the number will be one hundred millions, then two hundred millions, try and think what will be their condition. What proportion of all that host will be poor? and what will be *their* condition? What will life be to them, cast in a country such as our acts now promise to bequeath to them?

We need not go far, nor peer into the future to see the beginning of the end of all this. The increased price of fuel diminishes the comforts of the industrious poor, injuriously exposes their health, confines them to a mere defence of life, by consuming a

large share of their earnings, which else could have been used for education, for personal comforts, or the purchase of a home. A great increase in the price of lumber hinders the erection of dwellings. The poor man labors years longer to obtain the means to build a house. The growth of cities is retarded by it. Small and uncomfortable tenements are built. Rents are higher. The high price of lumber adds to the expense of furniture.

A wise and good man of France, Bernard Pallissy, three hundred years ago, in expressing his indignation at the folly of men in destroying the woods, said: "I cannot enough detest this thing, and I call it not a *error, but a curse and a calamity to all France*; for when forests shall be cut, all arts shall cease, and they who practice them shall be driven out to eat grass with Nebuchadnezzar and the beasts of the field. I have divers times thought to set down in writing the arts which shall perish when there shall be no more wood; but when I had written down a great number, I did perceive that there could be no end to my writing, and having diligently considered, I found there *was not any* which could be followed without wood."

There are several kinds of trees indigenous to these Eastern States, that now are, and must continue to be far more valuable in the arts than for fuel alone. The oak, hickory, and ash, in particular, for many purposes, so far as I know, are not equaled by any timber elsewhere.

In California the miner can find no wood for a lever or a pick-handle, better than a pine limb. The western half of our country produces no timber suitable to make a carriage, a wheelbarrow or any kind of farm implements. All these are now supplied from the East. American farm implements are in great request all over Europe. Germany in particular, buys all that reach there, as soon as they are landed, and is ever calling for more. The superiority of our tools and machines, which is everywhere admitted, over those made in Europe, is mainly in the better quality of the timber that enters into their construction. For handles to rakes, hoes, shovels, for scythe-snaths, for shafts and poles to carriages and harvesting machines, there is no other wood, that in the qualities of elasticity and strength, is equal to the American ash.

Taking a general view of American forests, we shall see our whole country west of the Mississippi, with perhaps an exception of a part of Texas, with no trees to spare for the further extension

of tillage alone. As population spreads over the arable portions of those vast regions, and the railroads are built through them, the one great check to business and to prosperity, will be the lack of timber. East of the Mississippi are the prairie States, and now other considerable portions of country, with no wood to spare. The available forests now remaining, to furnish all the wood that is seen to enter into home and foreign commerce, are embraced within a few of the States. These forests are cut away at the rate of three millions of acres annually, equal to one sixth the area of Maine. The country cannot many years longer rest in blissful ignorance of her impending fate. Let the present reckless habit continue, and before the present age of our nation shall be doubled, millions of the poor will be found burrowing in the ground and burning peat.

Another consideration, second only in importance to the one already noted, is that of *climate*, as affected by the removal of forests. The physical elevation and configuration of our country, to which I have briefly alluded, subjects it to great vicissitudes of climate. I have not time to examine this in a general way, but must come at once to Maine. Here we may speak of what we know, though there may be many things that we now fail to comprehend sufficiently to reason from them. We think we see changes going on in our climate. We who can speak from personal observation of the same locality through a period of fifty years or more, may be allowed to utter our convictions, that extremes of temperature now more rapidly alternate—hot and cold approach each other with more sharply defined lines and angles, than formerly. If we are not certain that rainfall has tended to greater irregularity, we are certain that snow covers and protects the ground with less regularity.

The first settlers in Piscataquis were obliged to wait a month or more after winter had set in here and sledding become good, before they could go to market at Bangor. Then in spring the snow would fail there a month or more before it did here. Now, when the woods are removed from nearly every hill-top between this valley and the ocean, the south winds reach here about as readily as they touch at Bangor; and it is a common occurrence for a loaded team to leave here for Bangor on a snow that scarcely covers the ground and return with the report, that there was more snow there than here.

The proof that the warm winds sweep over the State with greater freedom and force as the forests disappear, is proof that the cold winds become intensified also. But, it may be asked, what obstacle do trees present to the motion of the atmosphere, which is several miles in height or thickness? The atmosphere, movable as are its particles, and light and elastic as are its masses, is yet held together as a continuous whole by the law of attraction between its atoms, and therefore, an obstruction which mechanically impedes the movement of a given stratum of air, will retard the passage of the strata above and below it.

The action of the forest, considered merely as a mechanical shelter to grounds lying to the leeward of it, would seem to be an influence of too restricted a character to deserve much notice, were it not for the multitude of facts that are cited in the old countries, as well as by observations in our own, all concurring to show that it is an important element in local climate. I will introduce one statement to this point: "A spectator placed on the famous bell-tower of the cathedral of Antwerp, saw, not long since, on the opposite side of the Schelde only a vast desert plain; now he sees a forest, the limits of which are confounded with the horizon. Let him enter within its shade. The supposed forest is but a system of regular rows of trees, the oldest of which is not forty years of age. These plantations have ameliorated the climate which had doomed to sterility the soil where they are planted. While the tempest is violently agitating their tops, the air a little below is still, and sands far more barren than the plateau of La Hague have been transformed, under their protection, into fertile fields." Statements parallel with this from Belgium, may be gathered from all parts of Europe. Sunny France, where we have looked at another result from man's operations in a mountainous country, has lost most of her semi-tropical fruits, and only sees them restored as they are provided with shelter. Cortes, the Spanish conquerer of Mexico, left by his will, sugar plantations in the valley of the city, where now, owing, it is supposed, to the cutting down of the trees, the cold is too great for sugar cane or any other tropical production to thrive.

"At Worcester, Mass., careful observers attribute the greater difficulty now experienced in the cultivation of the more delicate fruits in that town, to the fact, that the encircling hills, formerly covered with trees, are now, to a considerable degree, laid bare."

"The laws of the motion of the atmosphere are similar to those of water. A bare hill gives no protection. The wind pours over it as water pours over a dam. But if the hill be capped with trees, the windy cascade will be broken into spray. Its violence will be sensibly diminished."* A forest near the coast, in any part of New England, protects those farther inland from the chilling east winds; and while such winds prevail, a person passing towards the sea, experiences a marked change of temperature upon crossing the last wood and especially the last wood-covered hill. A garden surrounded by tall trees admits the cultivation, even in our severe climate, of plants from a much warmer zone.

The first settlers in the counties of Kennebec and Oxford, raised good peaches in abundance. This fruit retired gradually from Maine, quit southern New Hampshire, lingered for a time in Massachusetts, and has finally been driven from all New England, except some favored spots where shelter has been provided; and that luscious fruit is still retiring southward, under protest, and seems unable to give assurance of making a stand north of Mason and Dixon's line. The same causes materially affect the more hardy apple. Trees are longer in coming to the bearing state. The general crop of the State has greatly fallen off. Orchards with the bleakest aspect, produce the least. In the last season, I have seen apple trees in this vicinity, under perfect shelter, loaded with fruit, while on the bleak hills, acres of orchard failed to yield a supply for one family.

But time passes, and the task grows under my hand. As I have jotted down on these leaves the words to be offered you as food for thought, as I have turned leaf after leaf to the pile, I have held in reserve the home points for a final appeal in behalf of the trees. But I must relinquish my purpose for this evening—and in doing so, will indicate in part, what was my design.

I designed to speak of the already destitute condition of some neighborhoods on the coast-line of our State, in regard to timber and fuel—where all the farmers in the present generation were cutting off their wood for the Boston market—all have now reached their last tree, and are bringing wood for their own fires from distant points on the coast. Now these same farms have nearly ceased to produce aught for man or beast, and domestic

* George B. Emerson—"Forests of Massachusetts." 1845.

animals have nearly been banished from them. I designed to call your attention to the general condition of the towns here about us, as they are, sixty years removed from man's first destructive onset. I designed an attempt to reconcile you to the wise plan of nature, by which you are placed on the immediate border of lands not suitable for farms, where you may go a little time longer, for your timber and your fuel. I designed to show you, that without this arrangement, of which you sometimes complain, this river's channel would be dry with each summer's drouth; and at some winter's rain, when the the naked hills and valleys should be deep frozen, the swift-retiring waters would sweep all your mills and bridges into the ocean. I intended to offer you, in imagination, a sleigh ride, on such a day as oft occurred in the last month, up this river valley, passing over the open country, mile after mile, in the teeth of a brisk nor' wester, and talk to you by the way, of the beauties of American landscape; or taking a wider circuit, count the proportional number of homes—one in a thousand possibly—where the owner, by a wise forecast, has nestled it in the lee of a wooded hill, where the benumbed traveler can take breath as he rides past it, and for the moment join the domestic scene, and participate in the pleasures which the clear, midday sunshine imparts to the herd of domestic animals. I had projected a tour with you to the mountains near Sebec Lake, and the higher points around, to look at the giant pines with up-turned roots, as they lie decaying on those hundreds of acres of now bare granite rock, to show you the wasting effects of fire on the borders of civilization. I designed to go on a tour of inspection, to see the location of the wood-lots that are to stand for your use after the lapse of the next twenty years, when, with your railroad and the promised increase of your village, 500 acres of wood will be required annually, instead of 150 acres as now. I wanted to talk in solemn words to the remnant of those vandals who still hang on the skirts of society, living upon the woods—rioting on the proceeds of cedar shingles!

I wanted to gather here the chums of my boyhood, and speak of the oar-makers, who long ago cut all the large ash trees in these towns. But those boys are not here. They have gone to distant States, or passed on to fairer climes, where, under the higher law, man's destructive power avails naught. It would avail nothing to lecture to the men who have, since the crusade of the oar-mak-

ers, overrun the county and nearly exhausted the younger ash trees for shovel handles and other purposes. But I would like to whisper in the ear of that woods-man, who, a few days since, cut a fine, young ash, to skid his road and guide his sled from a stone,—when he could have cut an alder as well,—that just such trees are worth one almighty dollar each, standing within ten miles of anywhere. I intended to go to the hills and talk with the owners of them, of the mistakes made in cutting away the wood where the soil was so thin that it has already gone down to the valleys, leaving the naked rock above;—and of the ways and means by which they should, at no distant day, be re-clothed in green. I wanted to advise land owners, while they planted fruit trees, to plant at the same time a forest screen to the windward of them, and advise with them as to the mode of doing it. I wanted to give the assurance, that in planting a belt of trees, first with our hardy evergreens on the cold side, our deciduous trees next, then on the warm side, the oak, hickory, chestnut and black walnut will succeed and grow here with nearly the rapidity they do in their native latitude. But I have already indicated a wider range of thought than should be compressed in one lecture. My purpose has been more to direct your attention to a subject of vital importance, than to attempt any solutions of its intricate problems.

While my subject has been in process of taking form, in the odd hours of the last few days, the exercise has not been to me one of unmixed play.* The whole subject matter is yet fragmentary, and scattered wide over the domain of physical nature. With my every effort to gather of these fragments and compress them into a unity, they have tended off in tangents, with a seeming affinity for each other in groups, looking here and there very like series of lectures waiting for curious hands, scintillating in the dreamy distance and eluding my present grasp of thought.

There is one consideration to which I failed to allude in the proper place—the opportunity that will be afforded for the formation and growth of taste and character in connection with arboriculture and sylviculture as they must soon be studied and practiced. Our surroundings as we make them, are but the outgrowth of our interior selves. As adding to the beauty of a

* The previous lecture of this course, was on the subject "Work and Play."

country, the forests are of the utmost importance; and no element of beauty is so completely manageable as trees.

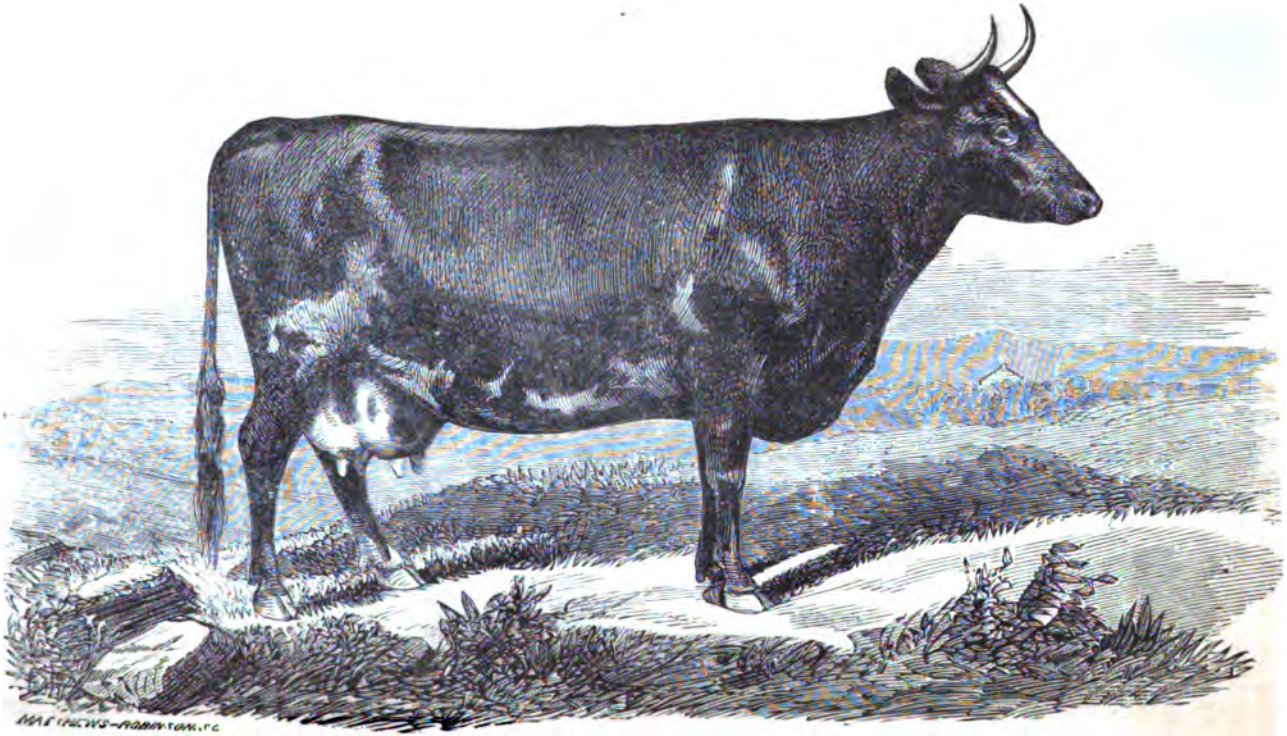
One practical fact I think you will have learned before you get far on your way in improving your lands by sheltering them—that is, that two thirds of your present area, well sheltered, will produce as much as the whole now does. *Sufficient shelter*, is so much as will save the snows of winter from being blown off the fields. A barrier to winds is found to act effectually over a space equal to ten or twelve times its own height.

There are some things that I would like to say in this connection, not exactly relevant to my subject. But when one finds it hard to "get the floor" in the world's great debating society, the speaker must make the most of his opportunity to reach the public ear, without any nice inquiry as to being "in order."

During these years, I have toiled as you have, for my bread and butter. While I have done so, I have not been unmindful that to my keeping was intrusted a section of that green fringe which I hope you may ever see as a border to your pleasant village. In an extended sense you all are joint owners with me in it. You all enjoy a seat or a walk under its dear, old trees as I do. While I have tilled it, I have not been unmindful of that part of it which still stands as nature clothed it. While I have tried to make the place a pleasant, green spot in spring-time, I have studied to so order it that much of the same light and shade should be continued through summer's drouth and winter's cold. While I have labored to preserve trees or to plant them for their shade and their fruits, I have talked with you of trees and of fruits as we have met day by day; and I here thank you for the degree of interest with which you have listened to me. And I have often thought to say to you, my neighbors, that the most of you will live to see the spot I have cared for these few years, pass to other hands. When it does pass, I hope it may be to one whose taste and habit may dictate a tender care of its trees.

From the character of our government—National and State—and the fact that the most of our land property is held by individuals in small parcels, it is pretty certain that when the evils of which I have spoken shall be stayed, it must come through individual effort—just as the character, habit, and prosperity of the nation at any time is but an aggregate of individuals in those particulars. As action is the expression of the highest intelligence

of the individual, so all general reform comes through the dissemination of higher light. As you farther examine the subject to which I have in so brief and imperfect a manner directed your attention, as your acts—the exponents of your convictions—shall take higher rank, worthy of the place you occupy as integrants of a great nation, in degree as you shall advance to the full discharge of your duty in this impending crisis, in the same amount and degree, shall be my reward for this effort.



Ayshire Cow,—"FLORA."—Owned by William Birnie, Springfield, Mass. Dark red and white; calved March, 1857; bred by George Richmond; imported from Scotland in 1859.

WHEAT CULTURE IN MAINE.

No other cereal furnishes so perfect a food as wheat. No admixture of other grain is requisite in order to make the best bread —the best single article of human food—best, because it furnishes in fitting proportions and palatable form, those flesh-forming, heat-supporting and force-yielding constituents needful to sustain life and vigorous strength.

No other cereal can wholly fill its place, hence it is recognized as one of the first necessaries of life in all civilized communities. Except for its perishable character, and its bulk and weight, it would be a more perfect standard of value than either gold or silver.

But the importance of wheat is too well appreciated generally to render necessary any extended remarks on this point, and hence I proceed to remark :

That the perfect culture of wheat requires the highest exercise of skill on the part of the agriculturist. This is true notwithstanding the fact that thousands of acres yielding plentifully are annually grown under the culture of ignorance. But this occurs only on the rich prairies of the West, or upon other virgin soils where nature's processes of storing up elements of fertility have been going on during periods of great and indefinite length. Upon such soils, as well as upon these of less natural wealth, it is simply a question of time how long such culture will be followed by remunerating returns.

Wheat culture in the United States, from the beginning, has been mainly an exhaustive culture. It has been the fashion to take as much as could be got from the soil without making much returns to it, and fast enough to suit the views of the croppers; and when returns came too slowly and too meagrely, to move on and ravish other virgin soils in like manner. It is too much as if their motto had been "After me the deluge"; utterly thoughtless of the needs of posterity, and ignoring their duty to leave the world better than they found it,—physically as well as morally.

The result of this course is, that the granery of New England

has been receding for many years,—it is now a good while ago that it passed her own borders, although many, and not very old men either, can remember when we only "went to New York to mill," and with no misgiving that the famed "Genessee country" might not be able to furnish all which might be wanted, and more cheaply than we could grow it at home; and yet the fact is that now the mills at Rochester do not depend mainly on wheat grown in the Genessee Valley, and not a little of the flour used on the Atlantic coast comes from the uttermost shores of this Western continent!

It is asserted upon good authority that "from Illinois, on an average, it costs the farmer three bushels of corn to get the fourth to market in New York; from all the Lake States it costs one half of all the wheat and flour to the farmer to get the rest to the markets of the world." If such be the fact it is obvious that the obstacles which intervene, notwithstanding the immense facilities for transportation which modern science and energy have achieved, are equivalent to a protective tariff of one hundred per cent. and upwards upon Western breadstuffs, which is paid by the consumer here.

It would seem that this must be abundantly ample to compensate for any disadvantages under which we may labor and to make its production here a paying business. Botanically speaking, wheat is a grass, or a member of the family of grasses, and its requirements, in regard to soil and food, do not differ materially from those of other nutritious grasses. Especially is this the case if we suppose the grass to be an annual variety and grown for its seed rather than for forage. In this connexion I am reminded of a conversation held some years ago with one of the most intelligent Scottish farmers I have ever met, in which I remarked that Maine produced very largely of hay with comparatively little grain; that our farmers generally thought the former could be grown to much better advantage than the latter. His reply was "If you can grow hay *to advantage*, surely you can grow wheat enough for home consumption;" to which I felt constrained to say, that our style of producing the hay was not probably such as he would consider *advantageous*, for much the greater portion of it was from large breadths which gave but a scanty yield—somewhat less than a ton per acre.

If we compare the acreage products of Maine with those of other sections, we find that our product of hay—the crop which is

grown here more extensively than any other,—is considerably less *per acre* than the yield of hay in other sections where wheat is known to be extensively grown; while at the same time, these wheat producing sections are content with an average yield of ten to twelve bushels per acre, an amount which would be deemed unsatisfactory here. I have freqently asked myself why is this so? and without becoming fully satisfied with any answer which has suggested itself. A plausible supposition would be, that Maine farmers had been taught by experience that the climatic and other conditions which prevail were more favorable to hay than to wheat; and also that they were content with altogether too low farming.

The time was when Maine grew her own breadstuffs, but for many years the complaint has been general, that "old land wont produce wheat as it used to grow on new land;" and so its culture gradually declined; the declension being greatly hastened, and with many reaching total abandonment, by reason of the advent of the midge.

Having already treated of the midge at considerable length in a former report,* in a paper devoted to "Obstacles to Wheat Culture," it may suffice here to offer two remarks merely; first, that this obstacle was never any more formidable here than it has been where wheat culture was more extensive, and notwithstanding the midge, was extensively continued up to the present time; and ought not to have caused an abandonment; and secondly, that there is now reason to hope that new natural enemies to the midge have been raised up or by some means introduced, which may hereafter lessen its rapid increase, as they have been known to do in Europe, whence the midge was brought to this country (probably in straw used for packing crates of crockery) but without the importation, at the same time, of the parasitic destroyer which there holds it in tolerably effective check. It is undoubtedly true that old land will not produce wheat with the same facility and abundance and the same lack of manure and skillful management as new land, but the time has come when it must be grown on old land or not at all, whether in Maine or in the other States of New England or in New York or in Ohio; and the same will be true of lands still farther West before very long.

And this can be done. It has been done for centuries in other and older countries. In England by improved methods of cul-

*Report for 1858, pages 125 to 150.

ture, better management, and especially by the aid of commercial manures the average yield has been raised within forty years from fifteen bushels or less to near thirty bushels per acre.

As the case stands now, there are farmers in Maine who tell me they have not failed to reap a fair crop of wheat in any season during a term of twenty, and some say, thirty years past. In some seasons the midge or the rust or mildew or other cause has prevented a large crop, but on the whole, the return has been as satisfactory as from other leading crops. It is an undoubted fact, and one which should never be lost sight of, that all commonly complained of hindrances fall with comparative lightness where-ever good cultivation prevails. It is chiefly where, from any cause, be it lack of skillful culture, lack of food or any other lack, plants (forming any crop) are afflicted with feebleness, hunger and general debility, that they invite the attack of diseases and calamitous visitations of all sorts, and fall a ready prey to them. Over the fence, under better treatment, in similar soil, the same kind of plants, healthy and robust, successfully resist the adverse influences which were fatal to the others.

SOIL.—In considering the subject of soil, for wheat or for any other plant, two aspects present themselves; first as a home for the plant, and thus chiefly of its mechanical character; and secondly, as furnishing the needful food to sustain vigorous growth of the plant; this involves its chemical composition. Wheat loves best a firm soil for its home, and for food, its requirements, (aside from those constituents which are usually found in sufficient quantity naturally,) are chiefly phosphoric acid, potash and nitrogen. The best soil for wheat is good, strong loam, containing clay enough to give it due consistence; in other words such a soil as you would prefer, if you could have choice of all, to grow grass upon. Stiff clays, *when well underdrained*, not only succeed well, but will sustain a growth of wheat during a longer term (other things being equal) than most other soils. Limestone and slate soils, such as prevail extensively in Aroostook county, are excellent. Sandy soils, although to a greater or less degree generally deficient in the qualities which fit it for a home for the plant and also in food constituents, sometimes succeed pretty well, especially if well fed.

For the successful growth of wheat and particularly for winter grain, it is absolutely essential that the land be *well underdrained* unless it be underlaid by a subsoil porous enough to allow the

free descent of surplus water, so that none remain in it for any length of time except so much as is held by capillary attraction.

Upon any soil of Maine having a fair degree of natural adaptation to the crop, by means of underdraining where needful, and judicious manuring and suitable culture, our belief is that a profitable crop of wheat may be grown in nine years out of ten.

MANURES.—Among the manures most frequently mentioned in connexion with the growth of wheat is lime. Wheat contains some lime—but only a very little—much less than is generally supposed—not more than one ounce in a bushel of grain, (and a little more in the straw,) while it contains rather more of soda than of lime, about four times as much magnesia, nearly nine times as much potash, and more than thirteen times as much phosphoric acid*.

It may not be safe to assert that soils are nowhere to be found so completely destitute of lime as to be incapable of furnishing the small quantity required as food for the wheat plant, but such cases must be comparatively rare. Nevertheless the application of lime is frequently of immense advantage in promoting the growth of wheat, especially on clayey soils. If we call lime a good manure for wheat, it is because the term manure is understood to embrace not only those substances which supply plant food, but also all such as may be used for the purpose and with the effect of accelerating vegetation, or of increasing the production of cultivated plants. During the early part of the present century the great topic of discussion among both practical and scientific farmers was the part which lime played in relation to the soil and to the crops benefitted by it. Some contended that it furnished food to the plant; some that it improved the texture of the soil; some that it converted inert matter into assimilable food. Modern science shows that these were, so far, *all* right. It is pretty certain, however, that the precise way or methods in which lime accomplishes all its beneficial results are not yet fully understood, although the researches of Profs. Johnston and Way and others have thrown some light on the subject. For instance, we know that clayey soils are rendered more friable and mellow by the action of lime; and also that some constituents of plant food in soil may, by its application, be liberated from insoluble conditions to one more available to the plants. Prof. Way says "If a plain practical far-

*Calculated from the reported mean results of thirty-two analyses by Profs. Way and Ogston.

mer is asked the reason why he lays lime on his fields he will at once point to the practical results by way of answer—thicker, more luxuriant and sweeter grass, larger and more equal and firmer turnips, bulkier and more abundant crops of barley and wheat, and above all the almost total disappearance of couch grass and other weeds. The clay-land farmer uses lime as a chemical agent, either to afford food directly to his crops, or to bring other substances into a condition in which they may act as such; and not only does he find that his crops are heavier, but he also discovers that the mechanical condition of the soil is altered. It has become softer, more easily plowed and harrowed and it carries a mellower surface. The light land farmer is also benefitted, for while the use of lime may act in some degree injuriously on the texture of his soil by increasing its looseness, still this evil, which can only be called such as regards the growth of wheat, is more than counterbalanced by its greater cleanliness, the ease with which it can be kept clean, and the increase obtained in the crops of grass, turnips and barley which are the special and natural products of such soils.

These remarks apply, however, to their full extent, only to land that has been well drained, or is dry from natural causes; for although even undrained or wet land may, in some notable degree, be improved by liming, it is only on a deep staple of dry earth that the action of lime reaches its maximum effect, or continues to exercise a permanent influence. Much money was at one time wasted in liming imperfectly drained land, and there is still very considerable scope for amendment in this respect. Drain first, and (when necessary) lime afterwards, is an agricultural axiom that should form the motto of every farmer who would wish to derive the full advantage of his outlay."

As above remarked, wheat requires about nine times as much potash as it does of lime; hence we see the value of an application of ashes which directly supplies this constituent of plant-food. Late investigations render it probable that potash may be indirectly furnished to plants by methods hitherto unthought of. Prof. Horsford has recently stated that an incidental effect of an application to the soil of superphosphate, that is to say, of a true acid phosphate, *is the liberation of potash from its insoluble connection with silica,* the condition in which it occurs in feldspar, and the forming of a soluble phosphate of potash. Since almost all the soils of Maine have originated in part from granitic or other

feldspathic rocks, there is every reason to believe that our soils contain potash in sufficient quantity to supply many successive crops of plants, *provided* it could be unlocked and set free, or induced to form soluble combinations from which plants could appropriate so much as their needs demand. This explains in part the remarkable results attending the application of a well made superphosphate. But it explains them only in part, for as above shown, phosphoric acid is a necessary constituent of wheat, to an extent greater than that of any other inorganic or mineral substance; about thirteen times as much being required as of lime. Phosphoric acid is a constituent of all soils not absolutely barren, but it usually exists in so small proportions (at least in such condition that plants can appropriate it,) that in order to grow fair crops it oftener needs to be added than any other single constituent of plant food.

It is usually applied in one of four ways; first in farm-yard dung, which when made from nutritious food may contain nearly one-half of one per cent. say ten pounds to the ton. Secondly, in wood ashes, leached or unleached. These contains a proportion varying with the kind of wood burned, from one and a half to four per cent. In wood ashes it exists in a form not at once wholly available to plants, but given up gradually upon weathering in the soil. Thirdly, in ground bones; these if pure, contain nearly twenty-five per cent., and in condition available to the plants proportionate to its fineness and the rapidity of decay of the animal matter which holds together the atoms of phosphate of lime. Fourth, in commercial phosphatic manures, such as guanoes, superphosphates, poudrette, &c. These vary widely, both as to the proportion they contain, and the degree of solubility of the combinations in which it exists. They may contain from three to thirty per cent., and the degree of solubility may vary as widely as the proportions.

A good superphosphate is now generally acknowledged to be the most efficient and economical means of supplying phosphoric acid. Speaking of the value of bones, Todd in his "Wheat Culturist" says, "If there is any one practice among American farmers for which they deserve sharp rebuke, it is for permitting such immense quantities of bones to be exported for the improvement of the agriculture of foreign nations. Thousands of tons of bones are collected annually in Chicago, Buffalo, New York and other populous cities and shipped to European countries, to fer-

tilize the land for raising turnips, wheat, fat cattle and sheep. And yet American farmers, in stupid quietude look on and say, 'It don't pay to collect bones and apply them to the soil.'

It will pay. They have not tested the application of ground bone. There is not a meadow, nor a pasture in the land—with very few exceptions—that will not be greatly benefitted by a dressing of raw bone. Thousands of acres of the best farming land in New England are in a low state of impoverishment for the want of a liberal dressing of raw ground bone. Such fertilizing matter is the very life of the soil. European farmers understand and appreciate this fact. They know it pays to ship bones from America to enrich their farms. The value of every ship-load of bones that is picked from our land cannot readily be computed in dollars and cents, to the agriculture of our country. England delights in her own fatness produced on the choice cheese of American dairies, while we mutter and grumble over a pot of the whey. Europeans rejoice over the rich, sweet American butter, while we are so unaccountably stupid as to be satisfied with the butter-milk. Our farmers dig and delve, and rake and scrape their grain fields, meadows and pastures to get phosphatic fertilizies to send to Europe to produce big crops of turnips, and then grumble and denounce their own land as good for nothing, because their turnips refuse to grow as they do in Eastern countries. The truth on this point is American farmers must save and apply more manure to their impoverished land; especially must they save bones for growing a crop of turnips. As soon as we can produce a bountiful crop of turnips, we can grow wheat. Wheat and turnips in England go hand in hand. And when the wheat soils of America are rendered sufficiently fertile to produce a crop of turnips, we may have the eminent satisfaction of seeing bountiful crops of choice wheat, where now the yield will scarcely defray the expenses of harvesting and threshing the crop."

"No bone dust, no turnips; no turnips no wheat;
No wheat and no turnips, no cattle no meat;
No turnips, no cattle, nor manure in the yard,
Makes bills for the doctors, and farming go hard."

In addition to the mineral elements required, wheat demands a larger supply of nitrogen for vigorous growth than almost any other crop. It cannot obtain this from the air, although four-fifths of the atmosphere consists of nitrogen. The supply of nitrogen to the wheat plant must be furnished through the soil, and hence the

universal testimony as to the efficacy of ammoniacal* manures. The experiments of Messrs. Lawes and Gilbert showed that, where every mineral element was present in the soil in quantity sufficient for a maximum crop of wheat, the crop was doubled by an application of 200 lbs. of sulphate of ammonia per acre.

Now since neither the straw nor grain of wheat, (nor rye, barley nor the so-called English grasses,) contain as much nitrogen as do clover or peas, (which grow well without ammoniacal manures,) it seems reasonable to conclude, as is generally held, that the grains and grasses, especially wheat, not only take up, but also pass off, during their period of growth, in some unknown form, a considerable amount of nitrogen. However this may be, sure it is that, a supply of nitrogen, in some available form is an indispensable requisite for the successful growth of wheat. And this brings us to the question, whether there is any way to supply this indispensable requisite otherwise than by farm-yard dung, of which the farmer always has too little, and cannot buy, or by ammoniacal salts, which he could buy if he had pecuniary ability, but which he also lacks?

If the experience of others, elsewhere, furnishes safe data as to what may be anticipated in Maine, this question can be answered in the affirmative. Other plants can be made to furnish it. Es-

*Nitrogen is the distinguishing element of organized substances. Compared with other elements, its affinities are very feeble. Its most characteristic feature is its indifference or reluctance to enter into combinations. When it does so it is usually in some roundabout way, and, as it were, temporarily and under protest, determined to escape as soon as possible. It is well for us that it is so, for if the oxygen and nitrogen of which the air is composed were to *unite* chemically, (forming nitric acid or aqua fortis) instead of remaining as they do, in the state of *mixture*, neither vegetable nor animal life could survive an hour. Explosive mixtures mostly owe their efficiency to the fact of their containing nitrogen which is ready to let go its partnership with other elements immediately upon being struck or touched by a spark. If it were not for nitrogen there would be little in the world of gunpowder, or gun-cotton, or percussion caps, or nitro-glycerine, or fulminating powders. Everybody knows the facility with which animal and vegetable substances pass into decay when life departs from them. During this decay the nitrogen quits its combinations; and usually leaves in company with hydrogen—in the form of ammonia. Ammonia is a combination of fourteen parts (by weight) of nitrogen with three of hydrogen. In the urine and solid excrements of animals as voided there is no ammonia—any more than in fish or flesh, but as these decompose and decay ammonia is evolved, *being formed during the changes going on*—and is readily recognized by its pungent odor. Ammonia readily parts with its nitrogen to plants, and hence the universally acknowledged value of ammoniacal salts as manures. Hence, too, the reader will see how the terms "nitrogenous" and "ammoniacal" come to be used as almost synonymous. It is simply because ammonia readily furnishes nitrogen to plants, and plants can get nitrogen readily from ammonia when they would not get it from the air which contains it in abundance, but in an unavailable form.

pecially and to great advantage can it be supplied through the agency of clover.

The wheat soils of Maine can be made to grow clover with ease. In some sections an application of a bushel or two of plaster (gypsum) per acre, will cause a plentiful growth. Leached ashes are excellent for the same purpose, and where these fail, super-phosphate will serve to effect vigorous growth. Mineral manures will suffice. Ammoniacal manures are not requisite to, nor do they help materially, the growth of clover. Clover has the power to obtain nitrogen, somehow or other, nobody knows how or from whence, but it is generally supposed from the subsoil by its long tap roots, and it stores up this nitrogen in the plant.

By virtue of the nitrogenous constituents it possesses, clover hay is supposed to go farther in repairing the waste of the system, and in forming muscle, or lean meat, (but less of fat,) than herds-grass, red-top or any of the proper grasses. The manure from animals fed upon clover, is certainly much richer in nitrogenous constituents than that from the grasses. It is true that farmers frequently get very little benefit from this superior richness of the manures from clover, but it is the fault of the management and not of the excrements. The richness is largely in the urine and this is too often lost entirely, and the solid parts are too often leached and its soluble portions lost to the owner's benefit. As Mr. Harris pithily remarked once, "a ton of such stuff as farmers call manure wouldn't furnish ammonia enough for a lady's smelling bottle." But it can be saved, and it ought to be saved. Careful calculations show that the nitrogen voided in both liquid and solid form, from the consumption of a ton of clover hay is worth a fraction over nine dollars, (and besides the nitrogen it has other constituents of value,) which is about half as much as is yielded by the consumption of linseed oil cake which is extensively used in England for combined feeding and manuring purposes, and which always bears a high price.

I am aware that many farmers have more or less prejudice against clover for feeding purposes, but I could never discover sufficient ground for it. As an agency for enriching and sustaining our lands, I am confident it deserves a great deal more attention than has been given to it. Its beneficial effects where extensively used, as in western New York, in some localities from twenty to forty years, are beyond all question. We can grow clover with greater ease and with fewer drawbacks than do the

farmers of England where they often complain that the land becomes "clover sick" and refuses to produce a crop.

Some diversity of opinion exists whether the better policy be to plow in the crop, or to harvest and feed it to stock, applying the excreta to the land. From such investigations as I have been able to bestow upon this point, and it is one of importance, the conclusion has been reached that, *provided* the liquid and solid excreta be fully preserved, it is much preferable to pass the larger part of the clover grown through the stomachs of animals. But if the saving of the excreta is to be after the style usually practiced by a numerical majority of farmers, I hold it better to plow the crop in, as more economical both in regard to labor and manure.

Another mooted point is the proper stage of ripeness at which the crop should be turned under. It is generally agreed that clover will furnish the greatest amount of nutriment for animals if cut when the earlier blossoms begin to turn, but if plowed in at this stage there is liability of too rapid fermentation to ensure beneficial results. Sometimes actual injury ensues. A very intelligent farmer, in the vicinity where I reside, informed me of an instance in his experience where he had a very heavy crop of clover so badly lodged that he thought it would furnish him an excellent opportunity to try the alleged benefits of green manuring, and he accordingly plowed it under. The result was that violent fermentation ensued, the weather and soil being warm, the land was "soured" as he termed it, and the fertility of his soil was very seriously injured for a term of years, in place of receiving benefit from its heavy manuring. Had the crop been allowed to remain on the surface until farther decayed, and then nearly dried before turning in, the result would undoubtedly have been widely different.

It does not follow that to plow in crops when they are in the best condition to cut as the food of animals, will result in the greatest benefit to the land. Practices which would be judicious in a climate so unlike ours as that of England may not be equally useful here. I have now lying before me a prize essay on green manuring, published in a recent number of the journal of the Royal Agricultural Society, in which the writer says, "it ought if possible to be plowed in either while it is passing into flower or is in actual bloom, for it then possesses its maximum of easily soluble and alimentary matter." Again he says, "the ground to be benefitted by the plowing in of green crops should be capable of bringing

them forth, if not luxuriantly, at least with such abundance as to furnish complete shade during their growth, and sufficient vegetative matters to occasion a rapid fermentation when buried." I do not say that this would not be good advice to follow in England, with tares, rape, buckwheat or mustard, the crops usually grown there for green manuring; but as at present advised I cannot recommend the plowing under of crops in Maine, until they be past bloom and partially dried. The result in such case will be a slower but equally effective decay, attended with a return to the soil of all the enriching matter which the plants had obtained from any and all sources, and without loss or injury by reason of the generation of noxious gases, which in our climate are sometimes at least, found to attend a too rapid fermentation. This I find, so far as my inquiries have reached, to be the general experience and testimony of practical men who have tested the matter under the conditions which prevail among us.*

Nor does it follow from the fact that the clover plant furnishes a particularly valuable agency towards the production of wheat, that the best place for wheat in the rotation is next after clover. It may be in some cases and not in others. Experience in divers places indicate this to be the fact. Even in Onondaga Co., N. Y., where as Mr. Geddes says, "The agriculture of this county is based on the clover plant. It is used for pasture, for hay and for manure. Strike this plant out of existence, and a revolution would

* Since the above was written an article appeared in the American Agriculturist from the pen of Joseph Harris, in which he quotes Mr. Geddes as recommending the plowing in of clover "when it is at full growth." To quote more fully, he says: "A few weeks ago an Ohio subscriber of the Agriculturist wrote me in regard to the best time to plow under clover for manure. I wrote him that I had little practical experience in the matter, but theoretically the best time was a week or ten days earlier than it should be cut for hay. Dr. Voelcker's investigations [Journal of the Royal Agricultural Society, Vol. 3, Part 1, 1867,] indicate that when clover bursts into flower there is no further accumulation of nitrogen, but that, on the other hand, there is a rapid formation of sugar and other nutritious carbonaceous substances. To cut clover for hay, therefore, as soon as it bursts into flower, would be a wasteful practice, but it is just the time to plow it under. We get no more nitrogen by allowing it to grow longer; and the more succulent it is, the more rapidly will it ferment and decay in the ground. I wrote to Mr. Geddes, one of the earliest and most enthusiastic advocates of clover, requesting his opinion on the point. In reply he said: 'Plow under the clover when it is at full growth. But your question can much better be answered at the end of a long free talk, which can best be had here. I have many times asked you to come here, not to see fine farming, for we have none to show, but to see land that has been used to test the effects of clover for nearly 70 years. On the ground, I could talk to a willing auditor long, if not wisely. I am getting tired of being misunderstood, and of having my statements doubted when I talk about clover as the great renovator of land. You preach agricultural truth, and the facts you would gather in this neighborhood are worth your

follow that would make it necessary for us to learn every thing anew in regard to cultivating our lands." He says, on a subsequent page of his admirable "Survey," "the most common and approved rotation is, first year, clover sod plowed in the spring and planted to Indian corn.*

Second year, oats or barley.

Third year, winter wheat,† sown on the stubble of the oats or barley, timothy grass seed, at the rate of four or six quarts to the acre being sown, either with a machine attached to the drill, or by hand; if by hand, immediately after the wheat is covered. In the following spring, red clover seed at the rate of eight quarts per acre.

Fourth year, a crop of (clover) hay and another for seed.

Fifth year, pasture."

Here we find one crop of Indian corn and one of smaller grain to intervene between the turning under of the pasture sod filled clover roots, and the crop of wheat. Mr. Geddes goes on to say that "in the south parts of the county spring wheat is sown extensively, and the rotation differs somewhat from that given. Much more land is there devoted to grazing, consequently there is less plowing and re-seeding for grass. The rotation given is most common in all parts of the county where grain is extensively grown." We could wish that Mr. Geddes had been somewhat more explicit regarding the longer rotation which prevails in those

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knowing, and worth giving to the world. So come here and gather some facts about clover. All that I shall try to prove to you is, that the fact that clover and plaster are by far the cheapest manures that can be had for our lands has been demonstrated by many farmers beyond a doubt—so much cheaper than barn-yard manure, that the mere loading of and spreading it, costs more than the plaster and clover. Do not quote me as saying this, but come and see the farms hereabouts and talk with our farmers.'

Of course I went, and had a capital time. Mr. Geddes has a magnificent farm of about 400 acres, some four miles from Syracuse. It is in high condition, and is continually improving, and this is due to growing large and frequent crops of clover, and *to good, deep plowing, and clean and thorough culture.*

We drove round among the farmers. 'Here is a man,' said Mr. G., 'who run in debt $45 per acre for his farm. He has educated his family, paid off his debt, and reports his net profits at from $2,000 to $2,500 a year on a farm of 90 acres; and this is due to clover. You see he is building a new barn, and that does not look as though his land was running down under the system.' The next farmer we came to was also putting up a new barn, and another farmer was enlarging an old one. 'Now, these farmers have never paid a dollar for manure of any kind except plaster, and their lands certainly do not deteriorate.'"

* This he elsewhere informs us is manured with about a gill of gypsum to each hill after it has come up.

† Manured with "nearly rotted manure" harrowed in.

sections where grazing is most extensively pursued, inasmuch as it would more likely furnish suggestions by which we might profit, than a rotation in which hay and pasture occupied the land only two-fifths of the time.

Another rotation which is highly approved in some parts of New York is as follows:

First year, corn on sod.

Second year, barley, followed by clover not cut, nor pastured, but allowed to rot down.

Third year, clover plowed under after attaining full growth, and afterwards sowing with wheat.

Fourth year, wheat.

Fifth year, clover and timothy for hay.

Sixth year, pasture.

Few questions meet the farmer which require for their satisfactory solution more experience and brains than the one "what is the best rotation for me to adopt?" No general answer can be given, because so much depends on the character of the soil, and subsoil, and climate, and other general conditions, as well as on the crop which is deemed the most important to favor.

If wheat is to be grown on strong clayey soils, and these *if properly drained and enriched* certainly possess advantages over others, (and we have a great deal of them along the coast line of the State,) I see not why the summer fallow may not be advantageously introduced. It would go far towards suitably mellowing, cleansing and thoroughly preparing the soil, with the additional advantage of permitting winter grain to be sown *in good season*, and this is a matter of no mean importance, since one of the most frequent causes of the failure of winter wheat in Maine has been too late sowing.

Considerable diversity of opinion prevails regarding the expediency of pasturing clover. Some maintain strongly, as the result of experience and careful observation, that land is left in better condition for subsequent grain crops, where the clover is cut and carried off, leaving the roots alone to fertilize the soil, than it is where the same clover is fed off by animals who in consuming it return to the land a considerable portion of what is thus eaten. A recent editorial article in the Mark Lane Express, acknowledging the fact to be of frequent occurrence, explains it as follows:

"There are few questions connected with agricultural practice, which give rise to more interesting research than the peculiarity

so frequently observed respecting the growth of a second cutting of clover, and its influence upon the succeeding grain crop. The speculations which have been advanced, and the explanations which have from time to time been given, appear to contradict so many well established opinions, which have generally been accepted as undeniable, that the question still appears shrouded in mysterious doubt. It is held, and we see no reason to deny its accuracy, that any crop grown upon the land, which may be cut and carried away, must of necessity have a tendency to impoverish the soil from which it is produced. It is true, that if such produce be removed to the homestead or fed off, upon other land, the farm remains uninjured; for this process then simply resolves itself into a transfer from one part of the farm to some other portion, of a bulk of vegetable matter, which being consumed by stock, is partially appropriated by the animals feeding thereon, and the residue again reaches the soil as manure. The peculiarity so frequently noticed in the growth of clover chiefly consists in the fact that land from which a second crop of clover has been cut and carted away, is in better condition for the growth of wheat, than when the same clover is consumed upon the field on which it is grown. Indeed, we may go so far as to say that even when such clover has been allowed to stand for seed, it is not uncommon for the same result to be observable.

This, we readily acknowledge, conflicts sadly with many established rules of agriculture; but these facts are none the less correct on that account. It is placed beyond all doubt, that the removal of a crop of clover—and still more so with a crop of clover-seed—must of necessity withdraw from the land much valuable fertilizing matter; and it follows as a natural consequence that the soil cannot be as rich in fertilizing ingredients as it was prior to its growth. And yet we have the paradox existing in the shape of an improvement in the crop of grain upon that portion which has had the clover taken away, as compared with that part on which the clover was fed on the land; or in other words a diminished degree of fertility is attended by an increase in the crop of grain.

It is clear that there must be some compensating influence to explain this result. It has been maintained by many that when the land is depastured, there is a considerable exposure of the soil to the scorching influence of the sun, and thereby the nature of the soil is said to be drawn out and its quality injured. We have lit-

tle opportunity of knowing what is really intended by this explanation, and, indeed, it can only be received as exceedingly indefinite. It is easy for any one to understand that manure exposed to the sun may lose some portion of its volatile constituents; but we have no corresponding loss taking place by the action of the sun upon the soil—so far, at least, as any trust-worthy researches have hitherto led us to believe.

We must rather seek for an explanation from some other influence more definite in its character, and more capable of accurate proof. In the luxuriant growth of clover we have one of the best illustrations known, in the entire scope of agricultural practice, of a crop gathering nutriment both from the soil and from that which is the common property of all—the atmosphere above it. Its roots penetrate into and through the soil, gathering therefrom the nutriment the crop requires, moulding it into new forms, and preparing it for being assimilated in the growth of the crop. This vigorous growth below the surface is accompanied by an equally luxuriant development of foliage above, which very powerfully co-operates in promoting the general increase of the crop; the activity of the roots has a fitting counterpart in the vigorous action of the leaves, which abstract from the atmosphere much valuable fertilizing matter; and thus, by the co-operation established, we have an accumulation of a rich mass of vegetation, valuable either as food or as manure, but its growth has been the result of an active development both above and beneath the soil. Any circumstances favorable for promoting vegetable growth would in such a case act favorably; and on the other hand, any condition unfavorable thereto must tend to diminish the produce.

If we now notice the growth of a crop of clover which is being depastured, we shall observe that many of the conditions of luxuriant growth are wanting; and as a consequence, we cannot have an equally extensive formation of vegetable matter. The irregular manner in which such clover is eaten not only destroys much valuable food which has been produced, but by the sheep eating into the centre of the plant its further growth is frequently effectually stopped, and thus much of the clover perishes, and leaves the soil exposed and in an unproductive condition. Further than this, the crop has no opportunity of making a bulky growth, the practice being generally to eat it as it is growing, rather than let the crop advance towards maturity, and then be fed off.

It is in the latter stages of growth that the two practices offer

the greatest contrast. When a moderate growth has been secured, the one portion may be set aside for feeding, and the other part reserved for mowing; but from this moment, the one is subjected to a process of a destructive character and the other is permitted to accumulate, with a constantly increasing force, vegetable matter of the richest character. Instead of the plant being plucked in its point of growth, the development goes on uninterruptedly; the soil, instead of being scorched by the rays of the sun, is kept moist by the overshadowing leaves of the clover crop, and thus the growth of the crop is encouraged. The growth, and consequent accumulation of rich vegetable matter, goes on until the period of full growth has arrived, and then the whole is cut down and removed. In the one case, the growth is interrupted during its most important stages; and, in the other instance, it is encouraged with its fullest luxuriance.

It is perfectly clear that by such luxuriant growth the demands upon the soil have been very greatly in advance of that removed from the soil by the portion fed upon the land; but we must not lose sight of the fact that the growth above the ground has been proportionate with the growth of the roots in the soil, and that a luxuriant crop of clover leaves such a rich legacy for the succeeding crop in the accumulations of vegetable matter produced by the decay of the clover roots. When the crop has been fed upon the land, the growth of the clover root has been impeded, and consequently the land is far from being in equally good condition for the growth of grain. True, we have removed from the land a considerable quantity of valuable fertilizing matter in the clover taken from the field; and yet, by the course of management pursued, there remain behind in the soil, accumulations of fertilizing matter of a different nature, but most valuable for the succeeding grain crop, which more than compensate for the loss. The advantages appear all on one side, for most remains where most has been removed; but, in the one case we have secured an uninterrupted and luxuriant growth, whereas by the process of feeding the clover, we have kept its growth impeded, and consumed it in such a manner that the land could not receive those stores of rich nitrogenized matter which the clover extracts from the air and adds to the land.

It must be admitted that there are exceptional cases to the more general rule we have referred to; but those variations may generally be shown to be traceable to other causes, and not in any

way to interfere with the rule. If, for example, the plant is weakly in its character and habit, or has partially failed upon the land, the difference in favor of cutting will be less evident; the closer and more abundant the crop may be, the more fully will the result be in favor of mowing as compared with feeding; and conversely, when the crop gives no evidence of growth, we ought not to look for results of as favorable a character as we should otherwise expect. The secret of the entire difference lies in the fact of an uninterrupted growth being encouraged until the fitting time arrives for its prompt removal."

Among the conditions which elsewhere attend the successful culture of wheat upon soils long cultivated, we find a due degree of fertilization of the soil to be an indispensable requisite. We all know how inadequate are the resources of the barn-yard of the Maine farmer to supply the means for directly manuring a sufficient breadth of land. We know also that his pecuniary resources are inadequate fully to supply the want by means of commercial manures. Doubtless he may purchase advantageously to the extent of his ability, *and the increase of crops thus effected add, year by year, to his barn-yard supply, and so every purchase may increase his ability to supply himself in the future.*

We have just seen that indirect manuring, through the agency of ameliorating crops, and a judicious rotation, may contribute materially to the due degree of fertilization which is required. Are these all the helps which are available to us? We think not. A careful study of the lessons taught by the enlightened and extended experience of old-land farmers in England, cannot fail to impress upon the mind as a point of great practical importance the connection which exists between the successful culture of wheat and sheep husbandry, together with root culture, and especially the culture of the Swedish turnip.

Hitherto, in Maine, sheep husbandry has been governed principally by considerations relative to the production, quality, and price of wool, and as a necessary consequence the numbers of sheep kept have been subject to great fluctuations. This is not the view which true policy would dictate. For the production of wool other States and and other countries possess natural advantages which we do not enjoy. These are so great that with all the help obtainable from high tariffs and greater nearness to the centres of woolen manufacture, we still labor under very considerable disadvantages. But no such disadvantages here attach to the cultiva-

tion of sheep considered as an agency for the production of meat and manure; decidedly the contrary is true. Meat is worth more, and manure is worth more, by a great deal than they are where the greater natural advantages above referred to, for the production of wool, are enjoyed. And this fact of to-day is growing bigger and more intense ever year. Good mutton is constantly appreciating in public estimation as an article of food. It has yet to advance a great deal more in the same direction, for the common estimate has been formed in large measure upon sheep meat of inferior quality; some of it very sheepy and very mean. Mutton is like Jeremiah's figs, the good very good and the bad very bad. It is doubtful if one in five of our population ever tasted first-rate mutton. It is doubtful if as large a proportion of our farmers give the sheep due credit for his usefulness as a manufacturer of manure, and as an improver of poor pastures.

No question at the present time receives more attention among the best agriculturists of Great Britain, than "how can I enrich my farm at the least cost?" The conclusions arrived at may be gathered from the enormous purchases of superphosphates, guano and the like, and also in the immense importations of food made expressly in expectation, (an expectation founded upon experience,) of receiving back a considerable proportion of their cost in the manure yielded from their consumption. That both methods pay well is entirely certain, but which pays best is not settled and probably never will be, because by reason of varying circumstances and conditions the replies given by results of experience are not uniformly in favor of one over the other. This is a matter for each to settle for himself.

Without doubt much remains for the Maine farmer to learn regarding the connection between root culture and wheat culture. The former may be made to serve a most important purpose toward such improvement of culture, and greater enrichment of the soil, as will contribute greatly to the success of the latter. Our climate may be deemed somewhat less favorable for the culture of roots than that of England. Still we grow better crops of potatoes than most other States, and wherever due culture and proper fertilizing additions are bestowed, we grow good crops of mangolds, carrots and turnips, and crops which are profitably grown also. It is not probable that the culture of roots in Maine will ever attain that degree of prominence which it holds in England. There turnips are fed to stock as a principal article of diet. To

fatting bullocks two hundred pounds daily is not considered too much. When fed to such an extent the returns are chiefly from the nutritive value of the root, and the manure yielded. But if given in much smaller amounts, say one tenth or one eighth as much, a very marked additional benefit is obtained in the alterative effect of the roots keeping the bowels open and the system in better health, and by the aid furnished toward the better digestion and assimilation of the drier food which constitutes their chief subsistence. For this reason roots deserve a great deal more attention than they receive.

But it is chiefly by reason of their influence as an ameliorating crop, by helping to improve and enrich the soil itself, that they deserve to be carefully considered in this connection. The manurial demands of the turnip are sufficiently met by the use of a good super-phosphate alone;—for if the plants are furnished with phosphoric acid in a soluble form, they seem to be able, in most soils, to obtain whatever else they require, and thus attain vigorous growth. In doing this, they undoubtedly draw very largely upon the atmosphere, while at the same time they obtain from the soil and subsoil, elements needful to the growth of wheat, but which the wheat plant seems unable to get directly from the same soil. When these are returned to the soil together with what is obtained from atmospheric sources, through the manure yielded from the consumption of the roots, the land is found to be enriched and adapted to the needs of the wheat plant to a degree far beyond what it would have been by merely adding the manure which served the requirements of the turnip.

Among the causes which contributed to the decline and fall of wheat culture in Maine were several which may be obviated by better practice. Especially is this true of the alleged degeneracy of the several varieties of grain which were from time to time introduced and cultivated. It is undoubtedly true that they became poorer and poorer, year by year, (as a general rule,) and finally so far run out that they were abandoned for others or for none at all. And why this result?—For the same reason that the domestic animals, the horned cattle, the sheep and the horses would have "run out" had as little pains been taken to improve the seed and the culture. Upon the latter, care and skill and expense have been bestowed, and the result is great improvement; but had they been as ill-bred, ill-fed and ill cared for, as the wheat plants were, they would have been as steadily running out.

Some years ago this subject was investigated both theoretically and practically by Frederick F. Hallett and the results arrived at were given to the public in an essay, the object of which was "to show that the wheat plant from its nature *requires a mode of culture which permits its perfect growth*, and that when so cultivated by the repeated selection of the seed, of which, as in breeding animals the record is a pedigree, we can gradually increase the contents of the ears without in the slightest degree diminishing their number."

From his essay we quote as follows: "It has for the past twelve years been my conviction that a good pedigree is as valuable in plants as in animals, and that in the careful rearing of seed which has this qualification lies our only means of materially increasing the produce of our cereals. Amongst animals whether horses, cattle, sheep or pigs the importance of "pedigree" is fully recognized, as also even in reference to *some* of our agricultural *plants*; for if a farmer wants a good cabbage, mangold, turnip, or carrot, he selects the seed from a good *parent*, but the moment he deals with the cereals he almost ignores the great principle of like producing like, which he admits, in the foregoing cases, to be not only a right one, but so important as to deserve much attention, and repay much outlay.

Yet the minutest characteristics of a plant of wheat will be reproduced in its descendants, so much so, that we can not only perpetuate the advantages presented to us in an individual ear, but *by the accumulation of selection* make further advances in any desired direction; the union of good qualities imparting a cumulative force, and their successive renewals and establishment conferring, as in animals a "fixity of type." To me it has always appeared that, while offering an earnest of what a better system would effect, the mode in which the best varieties of our cereals have been raised (that of starting with *accidentally* fine ears, and simply keeping the produce unmixed without any *further* selection,) is a very imperfect one, and that its attainments are perhaps of less value than the earnest which it offers of future success under a more complete system. For such beginning (and *ending* so far as selection is concerned) with an accidentally fine ear, is a very different thing from starting annually with one of a known lineage. Look at the almost parallel case of two heifers, identical in every respect but that of "pedigree;" the one what she is by accident, the other by design; the one worth £25—the other

£300; from the one you may obtain any imaginable kind of progeny, from the other only a good kind.

The formation of a race of high-bred cereals, in many respects, admits of more rapid, complete, and satisfactory development than that of animals, first, because they are far more prolific, which gives much greater choice in each renewed selection (besides favoring a rapid extension of the improved breed;) and next, because instead of that "delicacy of constitution" often found in high-bred animals, the very opposite character will prevail in the pedigree plant, which is descended from a line of ancestors, *each of which was the most vigorous of its year*, and possesses, in combination, those various good properties by which they, more successfully than others, withstood the vicissitudes of season experienced during the years of selection.

In illustration of these principles of selection, I now give the following results, due to their influence alone,—as the kind of seed, the land, and the culture employed were precisely the same for every plant for four consecutive years; neither was any manure used, nor any artificial means of fostering the plants resorted to:

Year.		Length, in inches.	Containing grains.	No. ears on finest stool.
1857.	Original ear, . . .	4⅜	47	
1858.	Finest ear, ...	6¼	79	10
1859.	Finest ear, ...	7¾	91	22
1860.	Ears imperfect from wet season,	–	–	39
1861.	Finest ear, ...	8¾	123	52

Thus by means of repeated selection *alone*, the length of the ears has been doubled, their contents nearly trebled, and the "tillering" power of the seed increased five fold."

Mr. Hallett's essay comprises many very interesting details which our limits forbid giving in full, but the following is added: "Before explaining the method of procedure adopted in the above selection, I will briefly state why I commenced with so small an original ear. I had for several years previously experimented on *accidentally* large ears, irrespective of the quality of the grain they contained; the invariable result was a sample so coarse as to be almost unsaleable. Convinced that this did not naturally result from the attainment of a perfect growth in the plant, but rather arose from the fact that the large parent ears, from some peculiarity of their growth, themselves contained coarse grain, I determined to commence with a fine *quality* of grain irrespective

of the size of the ear, trusting to pedigree for the gradual attainment of fine ears. I therefore started with the 'Nursery' wheat as the finest quality of red wheat known, as I have since done with several kinds of white wheat, such as 'Bellevue Talavera,' (kindly sent me for the purpose, by Colonel LeCouteur,*) 'Hunters White,' and several kinds of Australian white wheat which were all fixed upon on account of their quality alone.

The plan of selection pursued above is as follows:—A grain produces a 'stool' consisting of many ears. I plant the grains from these ears in such a manner that each ear occupies a row by itself, each of its grains occupying a hole in this row; the holes being twelve inches apart every way. At harvest, after the most careful study and comparison of the stools from all these grains, I select the finest *one* which I accept as a proof that its parent grain was the best of all, under the peculiar circumstances of that season. This process is repeated annually, starting every year with the *proved* best grain, although the verification of this superiority is not obtained until the following harvest.

During these investigations no single circumstance has struck me as more forcibly illustrating the necessity for repeated selection, than the fact, that *of the grains in the same ear one is found greatly to excel all the others in vital power*.

Thus, my original two ears together contained 87 grains. These were all planted singly. One of them produced ten ears containing 688 grains, and not only could the produce of no other single grain compare with them, but the finest ten ears which could be collected from the produce of the whole of the other 86 grains contained only 598 grains; yet supposing that this superior grain grew in the smaller of the two original ears, and that this contained but 40 grains, there must still have been 39 of these 86 grains which grew in the same ear. So far as regards *contents* of ears.

Again, this year (1861) the grains from the largest ear of the finest stool of last year were planted singly, 12 inches apart, in a continuous row; one of them produced a stool consisting of 52 ears; those next to and on either side of it of 29 and 17 ears re-

* This was originally raised by Colonel Le Couteur from a single grain. The ears and grains sent me by the Colonel in 1860 are absolutely identical in character with specimens grown in 1841, and now in the collection of the Royal Agricultural Society, showing how the influence of the original selection has been maintained for nearly twenty years.

spectively; and the finest of all the other stools consisted of only 40 ears.

By planting grains so as to form a plan of the position occupied by each when in the ear, I have endeavored to ascertain whether this superior grain grows in any fixed place, but hitherto these endeavors have not proved successful."

The suggestions of Mr. Hallett, it will be seen, open up a wide and highly interesting field for research and experiment, and I confidently believe that judicious labors in the direction indicated would achieve exceedingly fruitful results. The comparatively brief number of years; that is to say, compared with those required to effect corresponding results with domestic animals, should encourage many to enter this field who might distrust their ability for the patient waiting requisite for the building up of improved breeds of cattle, sheep or horses.

Another of the contributing causes of the decline of wheat culture in Maine was the exceedingly variable degrees of success attending the culture of winter grain. Many of the best crops ever harvested in the State were autumn sown, and so also were some of the most complete failures. A full statement of the various conditions which attended these successes and failures would form an interesting and exceedingly valuable chapter in the history of agriculture in Maine. I much regret having been unable to obtain sufficient data to furnish it. Some facts however have been gathered which may serve to throw a degree of light upon the subject.

It appears that many if not most of the successes have been upon lands which, either because of overlying a porous subsoil or from being filled with the roots and vegetable matter of a recent forest growth, or by artificial drainage, readily parted with any redundancy of water; and the converse is equally true, viz., many of the failures have been upon lands, which by reason of retentive subsoils *and lack of drainage*, retained a surplus of water. The facts regarding this point are such as to warrant the conclusion that it is inexpedient to attempt the culture of winter wheat except upon surfaces which are well drained,—either naturally or artificially. It may not be saying too much, that the same is also true of spring wheat, so great and manifold are the advantages of sufficient drainage upon any good wheat soils.

Regarding the effect of a continuous covering of snow in winter—so likely to occur in some parts of the interior, and so unlikely

upon portions of the coast line, there is more obscurity. Such a covering has been sometimes followed by what appeared to be a smothering of the young plants, and it has also been frequently followed by the best results.

It is evident enough that a fruitful cause of ill success has been *too late sowing*. From a comparison of all the facts which have been gathered on this point, it would seem that sowing during the last week in August has been followed by the best results, and that whenever deferred much beyond this, the chances of success were *greatly lessened.*

From the best information I have been able to gather, much the greater number of failures may be attributed to one of the two causes above alluded to, either lack of proper drainage in the soil, or too late seeding, and I am persuaded that the culture of winter wheat deserves much more attention than it receives from the farmers of Maine.

This persuasion has been confirmed by what I learn of the success attending its culture in New Hampshire, and I am very happy to be able to give the following valuable communication from a veteran agriculturist of that State, Levi Bartlett, Esq., of Warner, N. H., already well known to many of our farmers as a frequent contributor to the agricultural periodical literature of the country:

S. L. Goodale, Esq.: Your letter of 20th ult., soliciting notes of my experience in wheat growing was duly received. It affords me much pleasure to comply with your wishes in this matter. For some ten or more years I have had experience in growing winter wheat. I was induced to attempt this from the uncertainty of growing spring sown wheat on my low-lying farm. If sown early, the midge was pretty sure to greatly injure it, sometimes nearly ruining the crops. If sown late the rust was very sure to greatly injure it. Similar results followed its culture on all low-lying farms, so much so, that wheat growing was given up, except on the hill-farms, where, from a drier atmosphere and a free circulation of air, taking a series of years together, tolerably fair crops have been grown, ever since the midge first made its appearance here, over thirty years ago. However, for the past few years the midge has done but little injury to spring sown wheat, and many farmers are again cultivating it, that for a number of years gave it up. The above remarks apply to spring sown wheat.

Some fifteen years ago, the son of a farmer in this town was in

western New York, during the harvesting of winter wheat. He brought home fourteen quarts, all his valise would hold. This was sown early in September, on one-third of an acre of light, dry land, from which a crop of oats had been harvested. The ground was manured before being plowed. The wheat was sown and well harrowed in. Next spring the plants came out bright and green, none being winter-killed, and no injury from midge or rust. The season being favorable, the yield was sixteen bushels, being at the rate of forty-eight bushels per acre.

This small patch of winter wheat, and its great yield created quite an excitement among our farmers. Scores of them had never before seen a field of fall-sown wheat. All this farmer could spare, was readily sold at three dollars per bushel for seed. The results of the experiments in growing winter wheat, by different farmers, were, as might have been expected, "good, bad, and indifferent." Those sowing early in September, on well prepared and suitable soil, realized a yield of sixteen or more bushels, for the bushel of seed sown; while others that delayed sowing till after their corn was harvested, (sometime in October) generally reaped light crops, suffering badly by midge, rust, and winter-killing. Most of these farmers decided at once, that fall sown wheat could not be grown here. But the failure was not in our soil or climate, but the result of their inexperience and lack of knowledge in the proper culture of winter wheat.

I procured a bushel of the wheat above alluded to, and sowed it about the 20th of September (three weeks too late,) on one hundred rods of light, sandy land, from which a few days previously, a fair crop of white beans had been harvested. I applied 125 lbs. Peruvian guano, which was worked in by the use of the cultivator—the land not being plowed after the beans were harvested—some small patches, deeply covered by snow-drifts, were smothered. The yield however, was about ten bushels, most of which I sold at three dollars per bushel for seed.

For ten succeeding years, I grew more or less winter wheat—with the exception of two years I grew good crops. The two seasons in which I failed of growing paying crops, were occasioned by the disappearance of the snow, in March and April. The frequent freezings and thawings of the ground threw out the plants, so that I obtained but a few bushels per acre; but late in the season I mowed a fair crop of grass.

Most of the land upon which I have grown winter wheat has

been inverted sod. Plowed from middle to last of August, applying a fair dressing of manure or guano. I have grown it on alluvial soil, on sandy, gravelly, and on deep loamy soil, as also, on good, rocky upland. On this, from being badly plowed, the grass sprang up, lessening the yield. I have grown it on inverted timothy sod, on a clover ley, and after oats, and wheat after wheat—always manuring after the land was plowed ; freely using the cultivator or harrow before sowing the grain. Sowing from 25th of August to 10th of September. I have tried all of the above named ways, and kinds of soil, for the purpose (in part) of ascertaining the adaptation of our different soils and climate for raising winter wheat, and have come to the conclusion that fall sown wheat, is as sure a crop in New Hampshire, as it is in any other of the States of the Union.

I have experimented with a great variety of wheats—received from the Agricultural Department of the Patent Office, many of which were of foreign growth, being fine samples. But nearly all I experimented with proved too tender to withstand our northern winters. I have grown the early May from Kentucky, and a similar variety from Virginia, maturing some ten days earlier than the White Flint and similar sorts. But the yield has been light—still, they might be worth cultivating where there is danger from midge and rust. I have successfully grown Early Flint, Michigan Tuscan, White Blue Stem, Early Noe, from France, and several other similar varieties; all of which were white, bald or beardless wheats—making, first-rate, white flour, and generally, giving satisfactory returns.

It is said, by some experienced wheat growers, that the red-chaffed wheats are hardier and more productive than the finer, white sorts, and that the bearded varieties are less subject to injury from the midge, &c., than the beardless varieties.

In August 1860, I forwarded to Col. Boyd of Hancock, Maryland, five varieties of my winter wheat. The next August, he wrote to me, as follows: "All the varieties of the wheat you sent to me last fall, I observe are smooth, (bald.) There is a prejudice against smooth wheats, and I am beginning to be of the opinion, that it is not without substantial reasons. Certain it is that our smooth varieties are more subject to the ravages of the fly and other insects, and to the elemental diseases incident to the wheat crop, and yield little or nothing, whilst the bearded varieties, with but few exceptions, escape the insect and these diseases, and yield remunerative crops."

All the varieties, with one exception, that I have experimented with, in field culture, have been white, bald varieties, and in favorable seasons the yield has been from ten to sixteen bushels for the bushel of seed sown, from which it seems that the finer varieties of white wheats have yielded better in New Hampshire than they have in Maryland, and I have no doubt the white, bald wheats, would do as well in the State of Maine, as they have in the Granite State. But still, the red chaffed, bearded wheats might be less subject to injury from the midge, rust, &c., than the white, bald wheats.

In 1865, A. Bean, a farmer in this town, harvested forty-five bushels of prime, red chaffed bearded, winter wheat from three bushels of seed sown. In 1866, harvested thirty-five bushels, from two and one-half bushels sown. Another farmer grew about the same from an equal amount of seed—of the same variety. These, I think were the only fields of red wheat, that I have ever seen in this section.

In 1861, Col. Boyd of Maryland forwarded to me per mail a small package, of what is known there, as the "*Lancaster wheat*" He wrote, "The Lancaster wheat I forwarded, is the earliest of our wheats, and is in considerable demand with us for seed. It is somewhat singular in appearance when ripening, presenting the appearance of rust."

The envelope enclosing the wheat sent to me by Col. Boyd, in some way got rent, and a portion of the seed lost. There was just one ounce saved. This was sown in drills 1st of September 1861, harvested in July 1862. Have grown it till I have enough to seed half an acre or more this fall. I now think very favorably of it.

In looking over the "Monthly Report of the Department of Agriculture, for January, 1868," (which contains brief notices of farming operations in a number of the States,) I find these entries. The reports from New York say, "By far the greater part of the returns indicate the Mediterranean varieties of wheat as preferred, on account of hardiness, and greater exemption from insect attacks."

Returns from New Jersey say, "Mediterranean wheat, chiefly red, is almost entirely grown, being considerably less apt to be affected by rust and insects."

Report from Pennsylvania says, "Mediterranean wheat has generally been preferred, as being less affected by the frost, and

the fly and other insects. Though within a few years the Tappahannock wheat has been cultivated, with success in some sections, ripening from one to two weeks earlier than other varieties—while in other localities it is pronounced a failure. Between the red and white Mediterranean wheat, the former meets with most favor, as it withstands the ravages of the fly more certainly, and uniformly yields better than most other varieties. In Lancaster, they have an improvement upon the Mediterranean, called "Lancaster wheat," which is in general use in this and adjoining counties, and valued for its early ripening qualities. * * Some spring wheat is grown in the northwestern counties, but it is an uncertain crop and not profitable, and its cultivation is being abandoned."

The report from Delaware says, "In Newcastle county, the old bearded Mediterranean wheat is cultivated, preferred chiefly from its supposed greater immunity from attack of the Hessian fly and less liability to rust, it being ten days earlier in ripening than other varieties. In some other counties, several kinds of white wheats have been grown—the red Mediterranean gaining favor, on account of its early ripening and freedom from rust, though the yield is not large."

Now, friend Goodale, can you, or any one else assign any valid reason, why the Mediterranean, or other early and hardy varieties of winter wheat cannot be as successfully grown in Maine, as in any of the States from which I have quoted? I know it can be done in New Hampshire—and profitably too. My friend Bean, who grew forty-five bushels of red, bearded, winter wheat from three bushels sowing, sold a large portion of it, at $3.50 per bushel—in greenbacks.

In September 1863, Joseph Harris, then editor of Genessee *Farmer*, delivered an address at the Fair of the Monroe Co. Agricultural Society, N. Y., in course of which he said, "As good wheat can be raised in New England to-day as when the first Pilgrim landed on Plymouth Rock. I have within the past two or three years, seen as good wheat raised in Connecticut and New Hampshire as I ever saw in this State. But it won't pay! Wheat can be brought from the West cheaper than it can be raised in the East." It may be so, but still, there may be a difference of opinion upon this point. I think it was in 1862, I fowarded to Mr. Harris several varieties of winter wheat I grew that year. The cleaned grain was forwarded in glass vials,—fair

averages of the different kinds—also, sent sample heads—three or four of which were so nice, that he had engravings taken and inserted in the *Farmer*. He pronounced the samples of wheat sent, as good as the wheats grown in the Genessee Valley. But he says "they can raise wheat there cheaper than we can here in the East," and I have no doubt they can. But when flour of good quality is worth $18 per barrel, it must be a poor crop of wheat that "won't pay."

I presume there are thousands of farmers in Maine, who understand the growing of wheat, both fall and spring sown, as well, or better than I do, and doubtless there are others, who have not had much practical experience in its culture. For the benefit of such, I offer a few suggestions: In growing winter wheat, on a clover ley, or sward land, plow the ground sometime in August, completely inverting the sod; press down the furrow slices with a heavy roller, apply a fair dressing of well rotted manure, or compost. I find it better to spread the manure from the cart or wagon, by so doing, it can be more evenly distributed over the ground, than if first laid on the land in heaps. Then thoroughly work the ground with the cultivator or harrow. Sow the wheat by the first of September. Some farmers sow one and a half bushels per acre; others, two bushels. I have usually sown one bushel to an hundred rods of land. After the wheat is harrowed, in sow herdsgrass seed. Then pass the roller over the land. I think I get a better catch of grass in this way, than by sowing the grass seed with the wheat. By harrowing the ground after the grass seed is sown, much of it gets buried so deep that it fails to come up. In the following March or April, sow clover seed. Where I have pursued the above described course, I have seldom failed in obtaining fair crops of wheat, followed with good crops of hay. I have sometimes grown a crop of oats, after corn; manured the oat stubble, plowed the ground and sown wheat and grass seed. In one or two instances, the oats sprang up and retarded the autumn growth of the wheat and grass. Twice, wheat has followed wheat; but I think, I shall not repeat the process. I have never sown winter wheat after corn, because I could not remove the corn in season to sow as early as I wished.

Good, well preserved, farm-yard manure, doubtless, contains all the necessary constituents for the wheat crop. But in this section, most farmers think all their manure must be used for their corn and other hoed crops, and have none for winter wheat.

When good Peruvian guano could be had at $60 per ton, its purchase for growing wheat, was generally found a good investment. It is now quoted in the Boston price current at $100 per ton. I do not think it would pay to purchase at that price, with freight added, for either wheat or corn.

Mr. Lawes of England, by his experiments in wheat culture, on the strong soil he cultivates, and by his method of culture, does not find super-phosphate of lime, and other, so-called mineral manures, applied, either in large or small quantities, to add but about two bushels of wheat per acre, over unmanured land of the same quality. The unmanured, for a long series of years, averaging over sixteen bushels. The mineral manured plots yielding about eighteen bushels per acre, while those plots using, annually, about 320 lbs. of muriate and sulphate of ammonia, gave an annual return of over thirty bushels per acre. Ammonia seems to be the one thing needful on Mr. Lawes' soil to insure large yields of wheat. Over twenty years careful experimenting establishes that fact.

But on the other hand, there are well established facts, that prove beyond all cavil, that on other soils in England, the application of six hundred pounds of super-phosphate of lime, per acre, has increased the yield of wheat, twenty-four bushels,—even on a soil so fertile that it produced twenty-nine bushels of wheat per acre, without manure—while an adjoining acre that received 600 lbs. of super-phosphate of lime gave a yield of fifty-three bushels.

To account for these apparent discrepencies in the action of these manures, Mr. Lawes published a letter in the London Agricultural *Gazette*, explaining to my view, in a plain common sense manner, the causes of these different results, in the favorable action of super-phosphate on Mr. Leigh's soil, and its nearly non-effect on his, and also why the ammoniacal manures on his soil exhibited such marked results over mineral manures.

In view of the above, I think it would be for the interests of the farmers in Maine, and elsewhere, to experiment with super-phosphate on their wheat. They need not experiment very largely. If the wheat crop is not benefitted by its use, the phosphate will not be lost, for it will not be worked out of the soil—and it will come into requisition, sooner or later, in subsequent crops of clover or other leguminous crops.

Judging from Mr. Lawes' experiments, and numerous other recorded facts in wheat culture, I think the importance of a free use

of nitrogenous manure in growing wheat is not fully understood by the great mass of our farmers. From the fair per centage of nitrogen in a good "porgy chum" (capable of yielding ammonia,) and the phosphates contained in the bones, theory would say "it was the manure for the growing of wheat," and I believe practice would confirm it. The British farmers in past years have expended millions of dollars in the purchase of guanoes for increasing their yield of wheat. Guano is *digested fish*, in a more concentrated form, to be sure, than "porgy chum;" but its fertilizing constituents are the same, though less in amount, in a given weight.

There has never been any of this fish guano used by the farmers in this section so far as I am aware. A few weeks since, I was in Danvers, near Salem, Mass., and learned that the farmers there had been purchasing largely of "fish guano;" from which fact I infer they find it a cheap and efficient manure.

One of the great drawbacks on successful farming in New England is a deficiency of manure. If our farmers could have a full supply of this, for their hoed and grain crops, and for top dressing their pastures and mowing fields, there would be a much less number of our people emigrating to the fertile soils of the far West. Too many of our farmers never think of looking beyond the limits of their barn-yards for manurial resources, but plod on, year after year, in the old beaten track, complaining of high taxes, light crops, and the small profits of farming.

There are large farming sections in this country, where heavy crops of corn, wheat, oats, barley and hay, have been grown for a long series of years, without the use of animal manures; and still the fertility of those soils has been kept up. This, has been accomplished, by the use of clover, lime, and gypsum. Now what has been so successfully enacted in New York, Pennsylvania and many other States, can also be enacted in the Pine Tree State, and in the Granite State, and at a much cheaper rate, than it can be done in the purchase of stable, or any of the commercial manures in the market; though, doubtless, a judicious use of some of these, in connection with the clover, might be profitable.

I do not *know* but the farmers of Maine are in the practice of largely growing clover for enriching their lands, preparatory to raising corn, wheat, oats, barley, &c. But I *do know*, that such a course is not practiced to any great extent, any where in this section of New Hampshire. The reason why such a system is not practiced by our farmers, I presume, is because they are ignorant

of the advantages of such a course. And perhaps, this may be the case with farmers in some portions of Maine. If there are such, I will try to enlighten them on this important point.

Some ten years ago the Hon. George Geddes of Onondaga county, N. Y., ex-President of the New York State Agricultural Society, and one of the best practical farmers of that State, made a thorough geological, topographical and agricultural survey of Onondaga county. His survey is published in the Society's transactions 1859. In chapter sixth treating upon "Practical Agriculture," he says: "The agriculture of Onondaga county is based on the CLOVER plant, *Trifolium pratense*. It is used for pasture, for hay, and for manure. Strike this plant out of existence, and a revolution would follow, that would make it necessary for us to learn everything anew in regard to cultivating our lands. What their value would be without clover, we will not attempt to conjecture. We have this most valuable treasure, and appreciate it. Its influence and importance to us demands an extended account.

"There are two varieties of red clover, known among the farmers as the large and small—the smaller variety is generally preferred, as the large yields but a single crop of hay in a season. Clover seed is usually sown on winter wheat, in March or April, in quantities varying from two to ten quarts per acre—eight quarts is generally sown by the best farmers.

"Gypsum, at the rate of a bushel or more, is sown on an acre after the ground is settled, and the crop has commenced growing. Sometimes the sowing of the gypsum is deferred until the wheat is harvested, and then sown on the stubble as soon as convenient. If the season is wet, and therefore a growing one, the small kind of clover will be in full bloom before the frosts of autumn kill the plants.

"It is common to pasture this young clover moderately in the fall, and opinions are somewhat divided as to whether this injures the future growth of the crop.

"In the following spring, gypsum should be again sown on the clover, at the rate of a bushel to the acre. By the 25th of June, or the 1st of July, the small variety is ready for making into hay, and should yield a ton and a half to the acre. The general practice is to cut the clover for hay, when in full bloom, or as soon as the earliest heads show signs of ripening. The process of curing varies with the weather and different farmers; the general plan,

however, is to handle it as little as possible, and to cure mostly in the cocks. As soon as the hay is drawn away, gypsum, at the rate of a bushel to the acre should be sown. By about the first of October, the second crop will be ready to cut for seed. * * After the seed crop is removed from the ground, there is a considerable part of the crop of hay left, particularly if it was cut high, as it should be. This stubble is usually pastured to some extent.

"In the spring following, the ground is plowed, unless wanted for pasture. If plowed, corn, oats, barley or spring wheat is sown, and a good crop is confidently expected. The roots run deep into the soil, and thus pulverize it, so that a single perfect plowing brings it into a most satisfactory condition. Some of our best farmers plow their fields deep once in a few years, and then shallower plowing of this clover sod will show the long tap roots, that have been pulled up from the subsoil by the plow, projecting above the surface all over the field, looking like dead weeds. *These roots, have transferred the fertilizing matters of the lower soil to the surface.* * * The oftener we can fill the soil with roots, and then plow them under, and thus allow them to rot, the sooner we expect to get our land in condition to crop with grain. Clover is a bienmial, and two years is all that one seeding should stand.

"A very considerable part of the cultivated land of this county has never had other manuring than this clover and gypsum, and its fertility is not diminishing. These fields are not cropped with grain as often as those that have the benefit of barn-yard manure, but they are manured at much less expense.

"The cost of a fourth of bushel clover seed, at $6 is	1.50
do. sowing, is about " "	8
do. 3 bushels of gypsum at the mills, is	24
do. drawing the same,	12
do. sowing at three different times,	38
Total cost of manuring one acre,	$2.32

I had copied thus far from Mr. Geddes' Report, when it occurred to me, that I had two letters received from him several years ago, containing, as I think, valuable practical information for the farmers of New England. Portions of these letters I copy.

In December 1860, I wrote an article on green manuring, which was published in the "Country Gentlemen," of December 20. In that article I stated that "I had never seen a crop of clover plowed in for manuring in this section." A few days after, I re-

ceived a letter from Mr. Geddes on the subject. I wrote to him, asking leave to forward the letter to the editor of the Country Gentleman, for publication in that paper. A few days later I received an answer complying with my request. This explains the matter respecting these letters.

The first one is dated Fairmount, Onondaga County, N. Y., December 24th, 1860.

L. Bartlett—*Sir*: I have read with some interest your article in the Country Gentleman of the 20th inst., and am surprised to learn that you have never seen a crop of clover plowed in for manuring. When I wrote my chapter on practical agriculture, I was under the impression that I was saying very little that would be new to any of my readers. From my earliest recollections this plowing under clover has been the common practice with our best farmers. I have not yet seen as many winters as you have, but I am past life's summit—and cannot remember far enough back, to find the time when clover was not used for manure on the farm where I was born, and where I now live. You will see on page 109 of my Report, Prof. Norton's anyalyses of some soil and underlying rocks of a field that has been treated with clover and gypsum and no other manure fotfifty years. This is land my father bought of the State in the last century, taking the first crop of wheat off it in 1799. This year wheat was taken from this field—a good crop, say 25 bushels to the acre after barley last year. Great care is taken not to manure this field with anything but clover and gypsum, as it is intended to see how long this plan of fertilizing will continue to improve the crops, under our system of rotation.

When our lands were first cleared, they are not thought to be as good for corn as they are after they have been cultivated some years. Our green or gypseous shales are deficient in vegetable matter when new, and this is given by means of clover. In fact, I have never raised a large crop of Indian corn—that is to say, never over about 80 bushels to the acre, measured when fit to sell—and I do not call this a remarkable corn country, but we can average 50 bushels per acre.

Our crop of corn this year was on a 33 acre field, the yield was 67½ bushels to the acre, (135 bushels of ears) besides our seed which is traced up and not measured.

This field last year (1859) was mowed late in June and early in July, and was intended for seed, but the grasshoppers so injured the crop, that only about 8 acres was cut for seed, the rest was

tangled and tramped down by the cattle late in the fall. Last spring the clover started early, and we turned on the field 107 ewes, and pastured them until the sixth day of May. The field was plowed in a single land with care, and harrowed well, and worked both ways, the rows 3 by 3 feet apart, from 5 to 7 stalks were suffered to grow in each hill. The kind of corn was "8 rowed, yellow large." By the eighth of October the field was all harvested.

But an important point, and a new thing with us, was, there was no hand hoeing, except two or three rows around the outside, that could not be fully cultivated with the horse. We used cultivators made here with five steel teeth, sharp and thin shanks, that the soil might fall nearly in the place where it was found. The field, at the time of cutting up the corn was *remarkably free from weeds.* Had this field been manured with barn yard manure, this mode of cultivation could not have been adopted. The year 1859, we had ten acres of corn land manured from the barn-yard, and though twice hoed by hand, and clean on the first day of July, it had more weeds on it at the cutting up of the crop—more on one acre—than our 33 acres had on the whole field this year. The yields were about alike per acre. This point is important. Clover plowed under does not seed the land with weeds.

To show you further how we use clover, I give the case of 20 acres of pasture. In the year 1859, we took 28 bushels of wheat to the acre, and pastured it in the fall. On the 6th day of May, this year, we put 107 ewes on the 20 acres, and 18 cows, &c., and kept them on until time to wash the sheep; the clover growing faster than all these animals consumed it. When the sheep left the pasture to the cattle, the increase of clover was rapid, so that 5 or 6 acres were mowed by some of our men who had cows to winter. In August and the first days of September, we plowed under all we could of the clover, harrowed and sowed to wheat, and expect a first rate crop if the season is favorable, in fact we never had 20 acres of wheat that looked better than this at this time of year. * * I have made these statements, not for publication, but to cause you to think fully on what appears a new thing to you. I cannot say that your lands can be managed as ours are with profit—for I know nothing of your processes, except what may be learned from reading, *but I do think it is time to try manuring with clover with you.* Let me suggest:—Be careful to get good clean seed. We raise our own, and find it a profitable crop,

"You will excuse the liberty taken by an entire stranger in addressing this letter to you—and please not forget that it is not intended for publication—I should be quite unwilling to talk so much of my own affairs in public. * * *

Most respectfully, &c.,

GEORGE GEDDES."

As already stated, I wrote to Mr. G. for leave to have a copy of his letter published. Here follows his answer: "January 4th, 1861. *My Dear Sir:* Your esteemed favor of 29th ult. is received. I really did not write to you, in the expectation that my letter was to be published—but with a view to give you more facts in regard to using clover as a manure, than I had put into my Report. Of course I have no desire to limit the information to you, but on the contrary, you are just *right* in supposing that my desire to see agriculture prosperous is by no means limited to my *parish*. But I wrote in haste, and used my own affairs to convey my ideas—and I am not without fears that my letter would look crude and egotistical in print. But after all, I shall leave the matter, of how you shall dispose of it, to your own judgement.

I think I did not say in my letter, that last year was a very rainy and growing one. This may be important to show why our clover pasture produced so largely. Please remember this point, as otherwise false impressions might be made.

Perhaps I should further say that our 33 acres of corn, was the best field, considering its size, uniformity and every thing, that was ever raised on the farm—*and at the least cost.*

Many years since I received the award for the best farm in the State; (this did not prove any thing, except as against my competitors,) and out of this grew a discussion as to manure,—that has caused me to say many things in regard to CLOVER and gypsum for manure, that I suppose were not always credited by men living on other soils—but time is gradually bringing farmers to think—and sooner or later, it will appear, and be acknowledged that on *our* soils, there is no way of constantly increasing fertility equal to a free use of clover seed.

I *think*, that *wherever* clover can be made to grow well, this will be true—but my knowledge only extends on this subject, to our soils.

Yours, &c.,

GEORGE GEDDES."

Mr. Harris in his address, (at Rochester, N. Y.,) referred to some pages back, said, "There has been much said about the exhaustion of our soils, *but this one thing is certain:* as long as we can grow good crops of clover, the soil is capable of growing, so far as the constituents of the plant are concerned, *good crops of wheat*," and I am inclined to think Mr. Harris is right.

Now, friend Goodale, there is another "thing that is certain," viz.: We can, and do grow as "good crops of clover," in New Hampshire and Maine, as they can in other States. Then as far "as the soil constituents of thewheat plant are concerned," *we are all right.*

The orange-colored midge, that pest of our wheat crop, has never injured my winter wheat to any considerable amount. If the farmer sows chess and other vile seeds with his winter wheat, he will be pretty sure to reap the "likes of them"—so if he sows smutty wheat, he will be pretty sure to harvest smutty wheat. As regards spring sown wheat after a corn crop, it is my opinion the land should be plowed in the autumn, and left in the furrow to be acted upon by the frosts of winter, and prepared for the reception of the seed wholly by the use of the cultivator or harrow. After the wheat is harrowed sufficiently—sow the grass seed and finish off with a heavy roller. If the land is dry, there is no danger of its getting pressed down too solid.

Within the past few months I have received two or more letters from Henry Poor, Esq., now resident in New York. He formerly was engaged in farming in Andover, Mass., and was widely known for his success in the cultivation of winter wheat, and for his frequent and ably written articles in the agricultural journals on the importance of wheat growing in New England. Last fall he was in correspondence with the Governor of the State of Maine, upon this important question. But from the great length of this paper, I cannot here go into a review of his letters—any farther than to quote some of his statistics. He founds his estimates upon the presumption, that there is one barrel of flour required "for each person, which is a fair estimate." He says:

"Estimated cost for flour," based upon the population of the several States:

Massachusetts, 1,300,000 people. Flour at eighteen dollars per barrel, ... 22 millions.

Maine, 700,000, ... 12 "

Vermont, 350,000,	. . .	6 millions.
New Hampshire, 350,000,	. . .	6 "
Connecticut, 600,000,	. . .	10½ "
Rhode Island, 200,000,	. . .	3½ "
Total,	. . . .	60 millions

is a fair estimate at $18 per barrel for flour per annum." The above figures look large. How far they are correct, I have no means of judging. But Mr. Poor seems firm in the faith, that if our farmers would bestir themselves in the right direction, New England could furnish its own wheaten bread.

Some of our "old fogies," (to which fraternity I belong,) are strong in the belief, that if the managers of some of our Agricultural Societies would offer much larger premiums for the increased production of bread crops, and smaller premiums for horse racing and trotting, it would be better both for the morals and the mouths of our people.

LEVI BARTLETT.

WARNER, N. H., March, 1868.

ON SOME POINTS IN POTATO CULTURE.

The potato is the staple export crop of Maine. We sell some hay to go out of the State, but more potatoes; and since, on the whole, this export has steadily increased, while their culture in other States, lags behind the demand, there seems to be a probability that the breath devoted to their culture in Maine may continue to increase.

Upon the visitation of the "potato rot," their culture greatly declined, but as this plague wore away, attention was newly directed and occupied with many points connected with the history, constitution and propagation of the plant, and with the comparative productiveness, hardiness and freedom from disease of different varieties. All these points, together with many others, including the production of new varieties from seed, became matters of careful investigation and experiment with hundreds of cultivators in various parts of the country. Among these we may mention Chauncey E. Goodrich, of Utica. N. Y., whose labors were especially successful in the production of new varieties which have already displaced the sorts formerly cultivated to a great degree, and promise to accomplish still more in the same direction.

Notwithstanding the length of time, and the breadth of surface, over which the culture of the potato has been extended, there still exists a wide diversity of opinion in regard to many of the more important points of practice. Men, who would as soon cut off a right hand as utter known untruth, have assured me that planting small potatoes and few of them is followed by as good crops, and the growth of as large tubers, as if large potatoes and more of them had been planted; and that this conviction is the result of twenty or more years of experience and careful observation. Others, fully as truthful, are equally certain that the potato forms no exception to the law that "Whatsoever a man soweth that shall he also reap," and that careful observation of results during many years has taught them, beyond all doubt, that the planting of small tubers, or cut tubers, and few of them, as a general rule, will be followed by a meagre crop. Equal diversity of opinion prevails upon other points.

Nothing is more certain than that unaccountable results do sometimes, and not very unfrequently, follow all tillage operations. But this ought not to quench our thirst for knowledge. Nothing is more certain than that the laws of nature are fixed and sure, and that similar conditions will be followed by similar results. The difficulty is that we are not always able to perceive all the circumstances and conditions which contribute to bring about a given result.

It is only by deductions cautiously drawn from a very large number of carefully conducted experiments, eliminating, so far as possible, all sources of error, and excluding from the data upon which our generalizations are founded, the apparently anomalous results sometimes met with, that we can arrive at conclusions which may be acted upon with confidence in practice.

By far the most valuable contribution which has come to my knowledge, towards so desirable an end, is furnished by a series of experiments conducted by George Maw, in 1865, and reported in a prize essay, lately published in the journal of the Royal Agricultural Society of England. Had the same experiments been made with a dozen of the best American varieties in place of foreign ones, the results would possess additional value for us: nevertheless, there is small reason to doubt that the general tenor of the results would have been much the same in either case. It is greatly to be hoped that similar investigations may be made by those among us, if such there be, who have the ability and the leisure to conduct them to successful issues.

The reproduction of this essay in our pages will, I am sure, be heartily welcomed and carefully perused by every grower of this very important crop among our readers.

"The striking evidence obtained from a few experiments made during the year 1864 with the object of ascertaining the sized potato-set most profitable to plant, induced me during the past year to carry out a more extensive series on a systematic scheme: a brief report upon which I beg to lay before the Royal Agricultural Society of England.

The 129 trial plots, described in the accompanying tabular statement of general results (at pp. 174–179,) were arranged with special reference to the following questions, which I propose to consider under separate heads.

Firstly. As to the influence of the size of the set on the eco-

nomic results of the crop; *i. e.*, whether any increase, and to what extent, is obtained over and above the extra weight of the set, in the planting of large in lieu of small sets.

Secondly. As to the influence on the crop of the distance at which the sets are planted; or the results of close and wide planting of various sized potatoes.

Thirdly. As to the comparative results from planting similar weights of large and of small potatoes per acre.

Fourthly. As to the relative advantages of cut and whole sets.

Fifthly. As to the influence of thick and thin planting, and of the size of the set, on the proportion borne between the weights of the sets and the weight of the crop, and the rate of increase under various conditions.

Sixthly. As to the relative productiveness of different varieties of potato.

Much diversity of opinion seems to prevail on these points, which are of economical importance in relation to both the Farm and Garden cultivation of the crop.

The selection of the potato-sets appears commonly to be more a matter of present expediency than prospective profit. The general course is to appropriate the largest for use, the very smallest for pig-feeding, the tubers of intermediate size being preserved for replanting; this method of assortment results in the use of sets of from two to three ounces in weight, and a set of less than two ounces is as often planted as one exceeding three or four ounces.

Our primary question is whether an increase in the size of the set will produce an excess above the extra weight of the sets planted; such extra weight going to increase the strength of the individual sets without increasing their number?

The unequivocal results in favor of large sets, obtained from my experiments carried out in 1864, and recorded in the 'Gardener's Chronicle,' as well as from those which form the subject of this report, induce me to describe carefully the conditions under which the experiments were conducted.

Every precaution was taken to insure the most perfect uniformity in the conditions under which the various experiments were made. The manure was separately weighed out, and distributed on each 20 superficial feet of ground. The distance—2 feet—between the rows was the same throughout the trial ground; and to counteract the influence of any slight variations in the character of the soil, the particular experiments that would be brought into

immediate comparison were placed as nearly as possible in juxtaposition. External rows were rejected for the experiments, and planted with part of the ordinary crop; and every individual set was separately weighed and selected to the specified size, and planted to measure, at precise distances.

Notwithstanding these precautions, there was a want of correspondence in many of the individual results, which I would notice as a warning against depending on the evidence of single experiments; for instance, in plots planted under precisely the same conditions, and with no apparent difference in the appearance of the crops, the produce varied to the extent of several tons per acre. Similar inequalities, apparently unaccountable, will be found in all agricultural crops, and in the conduct of experiments every care should be taken that they are fully recognized in the calculation of results.

Under the head of "Accidental Variations of Result" at the end of the report, I shall consider this subject more in detail, and endeavor to show the extent to which these adventitious irregularities affect the general tenor of the experiments.

It remains now to consider separately the various points to which the experiments relate.

It will be found that I have in no case relied on isolated results, but drawn the conclusions from the general bearing of the series. Throughout the report the term "Gross Crop" will apply to the whole weight of potatoes produced per acre, and "Net Crop" to the balance of produce after deducting the weight of the sets from which it was grown.

Firstly. The influence of the size of the set on the economic results of the crop; or whether any increase, and to what extent, is obtained over and above the increased weight of the set in the planting of large in the lieu of small sets.

Several separate series of experiments may be cited in evidence of the influence of the weight of the set on the produce of the crop. An average of from ten to thirteen experiments with different varieties, planted one foot apart in the rows, gave the following results:—

Gross Returns per Acre.

	tons.	cwts.	qrs.	lbs.		ozs.	
Average of 13 varieties, 1 oz. sets . .	10	19	3	17	or	17.65	per set.
" 13 " 2 oz. sets . .	12	15	2	14	or	21.03	"
" 12 " 4 oz. sets . .	15	17	2	15½	or	25.39	"
" 9 " 6 oz. sets . .	20	6	1	9	or	33.44	"
" 6 " 8 oz. sets .	23	8	1	14	or	38.67	"

After deducting the weight of the sets, the net balances of produce per acre will stand as follows :—

			tons.	cwts.	qrs.	lbs.		ozs.	
Average of 13 varieties,		1 oz. sets	9	17	3	0	or	16.65	per set.
"	13 "	2 oz. sets	11	11	1	7½	or	19.03	"
"	12 "	4 oz. sets	13	9	0	2½	or	21.39	"
"	9 "	6 oz. sets	16	13	1	16½	or	27.44	"
"	6 "	8 oz. sets	18	11	0	16	or	30.67	"

The following are the amounts of *net* profit per acre for *each oz.* in the increase in the weight of the sets, from 1 oz. up to 8 ozs. (each oz. in the weight of the set occupying 2 square feet, being equivalent to 12 cwts. 17½ lbs. per acre) of seed.

	tons.	cwts.	qrs.	lbs.
From 1 to 2 ozs.	1	13	2	7½
" 2 to 4 ozs., for each extra oz.	0	18	3	14
" 4 to 6 ozs.	1	12	0	21
" 6 to 8 ozs.	0	18	3	14

The average of a number of experiments with different varieties planted 9 inches apart in the rows, gave very similar results as follows :—

Gross Returns per Acre.

			tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties,		1 oz. sets	10	12	0	23	or	14.21	per set.
"	12 "	2 oz. sets	15	2	2	11	or	18.45	"
"	6 "	4 oz. sets	17	17	3	12	or	21.99	"

After deducting the weight of the sets, the net balances of produce per acre stand thus :—

			tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties,		1 oz. sets	9	16	0	0	or	13.21	per set.
"	12 "	2 oz. sets	13	10	0	21	or	16.45	"
"	6 "	4 oz. sets	14	13	0	4	or	17.99	"

The average produce of a number of varieties planted at intervals of 6 inches in the row, also exhibited similar advantages in favor of the larger sets, viz :—

Gross Returns per Acre.

			tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties,		1 oz. sets	13	4	1	20	or	10.85	per set.
"	10 "	2 oz. sets	15	19	0	12	or	13.15	"
"	3 "	4 oz. sets	22	0	2	3	or	18.11	"

After deducting the weight of the sets the net balances of produce per acre stand thus :—

			tons.	cwts.	qrs.	lbs.		ozs.	
Average of 11 varieties,		1 oz. sets	12	0	0	13½	or	9.85	per set.
"	10 "	2 oz. sets	13	10	1	27	or	11.15	"
"	3 "	4 oz. sets	17	3	1	5	or	14.11	"

Every step in each of these three series of experiments gives, without an exception, unequivocal evidence that each increase in

the weight of the set produces more than a corresponding increase in the weight of the crop. The following statement will, however, shew that the advantage in the employment of large sets is much less striking in the early than in the late varieties; out of the examples before given the produce of the early varieties, planted one foot apart in the row, exhibit the following result :—

	Gross Crop.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
Average of 7 early varieties 1 oz. sets	9	3	3	26	8	11	3	8¾
" 7 " 2 oz. sets	10	14	2	17	9	10	1	10½
" 6 " 4 oz. sets	13	19	0	7½	11	10	1	22½
" 6 " 6 oz. sets	15	6	0	22	11	13	1	2½
" 2 " 8 oz. sets	7	17	0	21	2	19	3	23

Although there is throughout an increase over and above the extra weight of the sets, the advance between the larger sizes is not very marked, and is much below that wherein the early and late sets are averaged together. There is even a falling off in the produce of the 8 oz. sets, in comparison with those weighing 6 ozs.; but this is partly from accidental circumstances; the 8 oz. sets, being much sprouted before planting, indeed all the larger sets of the early varieties were much more advanced than those of smaller size. After separating the early sorts from the general average results of early and late, the average produce of the late varieties, taken separately, will stand as follows :—

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
Average of 6 late varieties, 1 oz. sets	12	0	0	15	11	7	3	26
" 6 " 2 oz. sets	15	3	1	19	13	19	0	13
" 6 " 4 oz. sets	17	16	0	24	15	7	2	11
" 3 " 6 oz. sets	30	6	2	11	26	13	2	19
" 4 " 8 oz. sets	31	3	3	24	26	6	2	26

Secondly. As to the influence on the crop of the distance at which the sets are planted; or the results of close and wide planting of various sized sets.

To establish this point, I shall compare, *separately*, each series of experiments on potatoes *of the same weight*, planted at different distances :—

Averages of 1 *oz. Sets.*

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
13 varieties, planted 1 foot apart .	10	9	3	17	9	17	3	0
11 " 9 inches apart	10	12	0	23	9	16	0	0
11 " 6 inches apart	13	4	1	20	12	0	0	13

Averages of 2 oz. Sets.

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
13 varieties, planted 1 foot apart	12	15	2	•4	11	11	1	7
12 " 9 inches apart	15	15	2	11	13	10	0	21
10 " 6 inches apart	15	19	0	12	13	10	1	27

Averages of 4 oz. Sets.

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
12 varieties, planted 1 foot apart	15	17	2	15½	13	9	0	2½
6 " 9 inches apart	17	17	3	12	14	13	0	4
3 " 6 inches apart	22	0	2	3	17	3	1	5

Averages of 4 oz. Sets (similar varieties.)

	Gross.				Net.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
3 varieties, planted 1 foot apart	15	8	3	24	13	0	1	11
3 " 9 inches apart	15	19	2	14	12	14	3	6
3 " 6 inches apart	22	0	2	3	17	3	1	5

These comparisons all shew an advantage in planting the smaller sets at intervals closer than 12 inches in the rows; but the results are not very decided, and in one or two cases the gain in the gross crop does not make up for the extra weight of the sets planted.

The following comparisons refer to the effect of planting the sets more than a foot apart in the rows.

Three experiments averaged together, viz :—

8 oz. "Flukes," 6 oz. "Flukes," and 4 oz. "Late Red," gave a gross crop of 23 tons, 16 cwts., 1 qr., 8 lbs., and a net average of 20 tons, 3 cwts., 1 qr., 17 lbs. The same sizes and varieties, planted at intervals in the rows of 1 foot 3 inches, produced a gross crop of 18 tons, 13 cwts., 1 qr., 2 lbs., and a net crop of 15 tons, 14 cwts., 3 qrs., 20 lbs.—a falling off of 4 tons, 8 cwts., 1 qr., 25 lbs. per acre. Indeed the produce of each set was, as nearly as possible, the same, whether planted a foot apart or 15 inches, so that the additional distance was so much loss to the crop. The average produce of 6 oz. and 8 oz. Flukes shews a similar falling off when planted more than a foot apart in the rows:—

	tons.	cwts.	qrs.	lbs.	
Flukes, at 1 foot, the net average produce was	17	10	1	25	per acre
Flukes, at 1 foot 3 inches "	15	8	2	6½	"
Flukes, at 1 foot 6 inches "	12	16	0	5	"

This diminution of the crop, through reducing the number of the sets per acre, is remarkably uniform, and as nearly as possible proportionate to the distance at which the sets are planted.

The general tenor of these experiments points to an interval of 10 or 12 inches in the rows, as being the most profitable distance at which to plant large full-sized potatoes, of from 4 to 8 ozs. in weight. A moderate increase in the net-crop may be expected from still further diminishing the distance when the sets are below 4 ozs. in weight; but this point will be again referred to in considering

Thirdly. The comparative results obtained from planting equal weights of large and small potatoes respectively.

In the previous series of comparisons (1) the advantage of large over small sets, placed at similar distances, was very striking, large sets producing a much greater crop than an equal *number* of small sets on the same area, and the crop bearing a very regular proportion to the weight of the individual sets. We have now to ascertain whether by diminishing the distance and increasing the number of small sets an equivalent can be obtained for the increased individual productiveness of larger sets.

1 ton, 4 cwts., 1 qr., 6 lbs. of sets per acre, planted as—

	Per Acre. tons.	cwts.	qrs.	lbs.
2 oz. sets, 1 foot apart, gave, on a number of experiments, a net average produce of	11	11	1	7
And as 1 oz. sets, 6 inches apart . . .	12	0	0	13
Balance in favor of small sets at close intervals of .	0	8	3	6

2 tons, 8 cwts., 2 qrs., 13 lbs. weight of sets per acre, averaging a number of experiments, planted—

	Per Acre. tons.	cwts.	qrs.	lbs.
As 4 oz. sets, 1 foot apart, produced a net return of .	13	9	0	2½
As 2 oz. sets, 6 inches apart	13	10	1	27
Balance in favor of small sets at close intervals of .	0	1	1	24½

4 tons, 17 cwts., 26 lbs. planted—

	Per Acre. tons.	cwts.	qrs.	lbs.
As 8 oz. sets, 1 foot apart, produced a net return of .	18	11	0	16
As 4 oz. sets, 6 inches apart	17	3	1	5
Balance in favor of large sets at wide intervals of .	1	7	3	11

3 tons, 4 cwts., 3 qrs., 8 lbs. weight of Fluke sets per acre, planted—

	Per Acre. tons.	cwts.	qrs.	lbs.
As 8 oz. sets, 1 foot 6 inches apart, produced a net return of	12	3	0	9
As 4 oz. sets, 9 inches apart	13	4	2	6
Balance in favor of small sets at close intervals of .	1	1	1	25

These balances are so small, that they can scarcely be relied on as indicating any decided advantage in either direction; but the nearly equal results of the experiments point conclusively to the fact of the very regular ratio borne between the weights of the crop and the weights per acre of the sets, a ton of sets, whether planted as large or small potatoes, producing the same weight of crop per acre. It must, however, be observed that *practically*, the principle is only of limited application. Taking 1 foot as the maximum, and 6 inches as the minimum distance between the sets in the rows, it will be easily understood that a weight of small sets, say of 1 or 2 ozs., equivalent to large sets of 6 or 8 ozs., could not be got into the ground, therefore the general principle, that the crop varies as the weight of the sets, weight for weight, is not practically applicable where the sets differ in weight beyond the proportion of 1 to 2. Small sets, therefore, of 1 to 3 ozs., can, under no arrangement, produce as much per acre as sets of from 4 to 8 ozs.

Fourthly. As to the relative advantages of cut and whole sets.

A comparison may be instituted between the average results of five experiments with sets formed by dividing large potatoes, and five experiments with whole potatoes weighing the same as the cut half sets.

Cut Potatoes.

	Net Balances. tons.	cwts.	qrs.	lbs.
Flukes, 4 ozs., cut out of 8 oz. potatoes, 1 foot apart, produced	12	2	0	23
Flukes, 4 ozs., cut out of 8 oz. potatoes, 9 inches apart, produced	14	10	2	4
Flukes, 2 ozs., cut out of 4 oz. potatoes, 1 foot apart, produced	10	4	0	21
Flukes, 2 ozs., cut out of 4 oz. potatoes, 9 inches apart, produced	11	13	1	12
Flukes, 2 ozs., cut out of 4 oz. potatoes, 6 inches apart, produced	8	6	2	1
Late Red, 2 ozs., cut out of 4 oz. potatoes, 1 foot apart, produced	23	7	1	0
Aggregate on six acres of	80	4	0	5
Average per acre	13	7	1	10

Whole Potatoes.

	Net Balances. tons.	cwts.	qrs.	lbs.
Flukes, 4 oz. sets, 1 foot apart, produced	13	3	3	23
Flukes, 4 oz. sets, 9 inches apart, produced	13	4	2	6
Flukes, 2 oz. sets, 1 foot apart, produced	7	5	0	27
Flukes, 2 oz. sets, 9 inches apart, produced	5	12	3	17

	Net Balances. tons.	cwts.	qrs.	lbs.
Flukes, 2 oz. sets, 6 inches apart, produced . .	7	10	2	23
Late Red, 2 oz. sets, 1 foot apart, produced . .	30	15	2	26½
Aggregate on six acres of . .	77	13	0	10½
Average per acre . . .	12	18	3	11

Showing an average balance in favor of the cut sets over an equal weight per acre of whole sets of about 8½ cwts. per acre.

In another instance.

	tons.	cwts.	qrs.	lbs.
Flukes, 3 oz. sets, cut out of 6 oz. sets, 9 inches apart, gave	14	8	1	23
And Flukes, 6 oz., uncut, planted 1 foot 6 inches apart .	13	9	0	1
Showing a net balance in favor of the cut sets of .	0	19	1	22

Both these comparative series indicate a slight advantage in favor of the cut sets; but since the individual experiments do not all point in the same direction, the result of the series cannot be looked upon as at all decisive; but it rather tends to the conclusion previously indicated, that the *weight per acre* of the sets planted has more to do with the produce of the crop than any other circumstance.

Fifthly. As to the influence of thick and thin planting, and of the size of the set on the proportion borne between the weight of the sets and their individual produce, and the rate of increase under various conditions.

This subject presents itself under yet another aspect, which interests the physiologist rather than the farmer, viz., the proportion borne between the weight of the sets and the weight of the crop, or, in other words, the rate of increase. This rate, as was to be expected, is larger as the sets are smaller and as the distance is greater, up to 1 foot apart, beyond which space no perceptible change takes place.

On the general average of these experiments—

The 1 oz. sets increased	14.24 fold
The 2 oz. "	8.77 "
The 4 oz. "	5.87 "
The 6 oz. "	5.81 "
The 8 oz. "	4.83 "
At 1 foot interval, the 1 oz., 2 oz., and 4 oz. sets increased .	11.50 fold
At 9 inches " " "	9.64 "
At 6 inches " " "	7.73 "

The rate of progression was found to be very regular, both in individual experiments, and in average results.

Sixthly. As to the relative productiveness of different varieties of the Potato.

To avoid undue complication, the varieties employed in these experiments have been rather limited, and the question of their relative productiveness has only been a matter of secondary importance. As, however, several of the varieties are very generally cultivated, it may be well briefly to state the results.

The average produce of 1 oz., 2 oz., and 4 oz. sets planted 1 foot apart in the rows was as follows on the gross crop per acre:—

	tons.	cwts.	qrs.	lbs.
Late Red	27	10	3	8½
Spencer's King of Flukes	19	13	2	17
Second's Kidney	16	0	3	12
Daintree's Seeding	15	8	1	25
Queen of Flukes	15	3	0	7
Flour-ball	14	2	1	23
"Vite-lots" (French Kidney)	13	6	3	19
Flukes	10	0	1	19
Early Handsworth	6	18	1	23
Early Prolific Kidney	4	14	1	18

The average produce of four series of experiments, viz., 1 oz. and 2 oz. planted at 9 inch intervals, and 1 oz. and 2 oz. at 6 inch intervals, stand in the following order:—

	tons.	cwts.	qrs.	lbs.
Late Red	27	9	1	20½
Spencer's King of Flukes	24	4	2	24
Daintree's Seedling	15	13	0	0
Flour-ball	14	18	3	20
Queen of Flukes	14	15	3	11½
Second's Kidney	14	9	3	3
Lapstones	11	4	3	5
Early Handsworth	7	14	2	17
Flukes	7	6	0	3
Lemon Kidney	7	4	1	20
Early Prolific Kidney	6	12	2	18

The crops produced from 6 oz. sets planted 1 foot apart, stand in the following order of productiveness:—

	tons.	cwts.	qrs.	lbs.
Late Red	37	18	3	0
Spencer's King of Flukes	30	19	3	12
Second's Kidney	26	8	2	22
Daintree's Seedling	25	16	2	5
Flukes	22	1	0	21
Early Handsworth	13	16	2	0
"Vite-lots" (French Kidney)	13	8	1	8
Lapstones	11	19	0	3
Early Prolific Kidney	7	9	3	17

Of "The Queen of Flukes" and "Flour-ball," there were no experiments with 6 oz. sets.

The relative productiveness of the several varieties grown from 8 oz. sets, planted at intervals of 12 inches, stand thus :—

	tons.	cwts.	qrs.	lbs.
Late Red,	38	19	2	25
Spencer's King of Flukes,	34	0	2	14
Queen of Flukes,	30	5	2	9
Flukes,	21	9	3	19
Lapstones,	4	17	0	26
Early Prolific Kidney,	3	15	1	11

The above four series of comparisons are tolerably uniform, as expressing the relative productiveness of the varieties they include. The actual order of precedence of some of the individual varieties, that do not differ much in their produce, varies a little; but the relative positions are, in general, uniform; the late red in each set of experiments produced the heaviest crop; and the Early Prolific Kidney appears in every case at the bottom of the list.

Of the three varieties of Fluke, the greater productiveness of both Spencer's King and the Queen of Flukes, than that of the ordinary variety, is very noticeable; Spencer's King especially, throughout the series, producing from half as much more, to twice as much as the Common Fluke, not only in the general averages, but in all the individual experiments.

Seventhly. Accidental variations of Result.

It has been necessary, in drawing our conclusions, to altogether avoid relying on the results of isolated experiments. Whatever precautions may be taken to ensure uniformity in the conditions under which agricultural experiments are conducted, unaccountable anomalies in the result will be found to occur; variations which affect all agricultural crops, and which should be fully recognized and guarded against when inferences are drawn from experiments.

The only way to remove such sources of error is to throw together the average results of a number of independent experiments, so that the irregularities tending in either direction may neutralize each other. I would cite, by way of illustration, the individual trials making up the average results given under the first head.

At page 164 it was stated that the *average* balance on 13 experiments, in favor of 2 oz. over 1 oz. sets, was 1 ton, 13 cwt., 2 qrs., 7½ lbs. per acre; but if we come to details, it appears that, out of these 13 experiments, 5 show a result in favor of the 1 oz. sets, and 8 in favor of the 2 oz. This proportion, 8 to 5, taken by itself, is not very striking, and might be accidental; but when the sum of the weights of the gains in favor of the larger sets is placed

against that in favor of the smaller sets, the proportion is increased to 25 to 5.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The gains per acre on 8 experiments, in favor of 2 oz. sets over 1 oz. sets, is	27	8	3	22½
Whilst the gain on 5 experiments, in favor of 1 oz. sets, is but	5	12	2	6¼
Leaving a balance in favor of 2 oz. over 1 oz. of	21	16	1	16¼
or 1 ton 13 cwt. 2 qrs. 7½ lbs. per acre.				

Even this result taken singly might be merely accidental; but when the other steps in the same series show precisely similar tendencies, the general tenor must be accepted as confirming the indications given by the majority of the individual experiments.

In comparing the produce of 2 oz. and 4 oz. sets, out of 12 experiments, the net results of 8 are in favor of the 4 oz. sets, and 4 in favor of the 2 oz.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The gains per acre on the 8 experiments, in favor of the 4 oz. sets, amount to	28	19	3	2½
And those on the 4 experiments, in favor of the 2 oz. sets, ...	9	15	2	11½
Leaving a balance in favor of the 4 oz. over the 2 oz. sets of	19	4	0	19
or 1 ton, 12 cwts., 0 qrs., 1½ lbs. per acre.				

In comparing the produce of 4 oz. and 6 oz. sets, out of 9 experiments, 7 are in favor of the larger sets, and 2 of the smaller.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The gains per acre on the 7 experiments, in favor of the 6 oz. sets, amounted to	30	0	2	15½
Those on the 2 experiments, in favor of the 4 oz. sets, to	12	12	2	10½
Leaving a balance in favor of the 6 oz. over the 4 oz. sets, of	17	8	0	5
averaging 1 ton, 18 cwts., 2 qrs., 19 lbs. per acre net.				

Advancing from 6 to 8 oz. sets, out of 5 experiments 2 are in favor of 8 oz., and 3 in favor of 6 oz. sets.

	Net Balances.			
	tons.	cwts.	qrs.	lbs.
The sum of the gains per acre on 2 experiments, in favor of 8 oz. sets, amounted to	7	13	3	22
And those on 3 experiments, in favor of 6 oz. sets, amounted to	6	17	2	27
Leaving a net balance in favor of 8 oz. over 6 oz. sets, of	0	16	0	23
on 5 experiments, averaging 3 cwts., 0 qrs., 27 lbs. per acre.				

Of the whole series of 39 experiments, 25 were in favor of large sets, and 14 showed an opposite tendency; but the proportion

borne between these numbers does not fully represent the actual result, which is more fairly stated by the weights of the balances on either side; for whilst the gains on the 25 (acres) experiments calculated per acre amounted to 94 tons, 3 cwt., 1 qr., 6½ lbs. in favor of large sets, the gain (14 acres) on the 14 experiments favorable to the smaller sets amounted to only 34 tons, 17 cwt., 1 qr., 27½ lbs., leaving (after setting the gains against the losses) an average net balance, on the 39 comparisons, of more than 1 ton, 10 cwt. in favor of the larger sets on each advance, namely, from 1 to 2 ozs., from 2 to 4 ozs., from 4 to 6 ozs., and from 6 to 8 ozs. I have been particular in noticing these exceptional irregularities, and their general bearing on the tenor of the experiments, as an element inseparable from agricultural experiments, and as requiring the fullest recognition in the estimation of results.

It now only remains briefly to recapitulate the general bearing of the experiments, the results of which have been described in detail.

Firstly. Every increase in the size of the set, from 1 oz. up to 8 ozs. in weight, produces an increase in the crop much greater than the additional weight of the set planted. *The net profit* over and above the extra weight of the sets in planting 4 oz. sets in lieu of 1 oz. sets, amounted on the whole series of experiments to between 3 and 4 tons per acre; and the further *profit* on the increase of the size of the set from 4 ozs. to 8 ozs., averaged about 5 tons an acre; all the intermediate steps partaking proportionately of the increase.

Secondly. The advantages in favor of the large sets is more marked in the late than in the early varieties.

Thirdly. In the use of small sets of from 1 oz. to 3 ozs. in weight, a larger balance over and above the weight of the sets was obtained by planting from 6 to 9 inches apart in the rows than at wider intervals.

Fourthly. Increasing the intervals at which the sets are planted, even of the largest size, in the rows to more than 12 inches, diminishes the crop, and the wider intervals induce no increase in the weight of the produce of the individual sets.

Fifthly. It may be broadly stated that the weight of the crop is proportionate to the weight per acre of the sets, and that small sets will produce the same crop as an *equal weight per acre* of large sets. The fact is, however, of limited application, as a weight of very small sets equal to a weight of full-sized potatoes

TABLE 1.—RESULTS of EXPERIMENTS on the POTATO CROP,

No	Variety of Potato.	When Planted.	Manure and Remarks.	Distance in the Row. ft.	in.
1	Early Prolific .	March 2	20 tons of stable manure per acre . .	1	0
2	Early Prolific .	" 2	Ditto ditto . .	0	9
3	Early Prolific .	" 2	Ditto ditto . .	0	6
4	Early Prolific .	" 1	Ditto ditto . .	1	0
5	Early Prolific .	" 2	Ditto ditto . .	0	9
6	Early Prolific .	" 2	Ditto ditto . .	0	6
7	Early Prolific .	" 1	Ditto ditto . .	1	0
8	Early Prolific .	" 1	Ditto ditto . .	0	9
9	Early Prolific .	" 1	Ditto ditto . .	0	6
10	Early Prolific .	" 1	Ditto, sets much sprouted . .	1	0
11	Early Prolific .	" 1	Ditto, sets much sprouted . .	1	0
12	Flukes . . .	" 8	20 tons of stable manure per acre . .	1	0
13	Flukes . . .	" 8	Ditto ditto . .	0	9
14	Flukes . . .	" 7	Ditto ditto . .	0	6
15	Flukes . . .	" 8	Ditto ditto . .	1	0
16	Flukes . . .	" 7	Ditto ditto . .	0	9
17	Flukes . . .	" 7	Ditto ditto . .	0	6
18	Flukes . . .	" 7	Ditto ditto . .	1	0
19	Flukes . . .	" 7	Ditto ditto . .	0	9
20	Flukes . . .	" 9	Ditto ditto . .	0	6
21	Flukes . . .	" 7	Ditto, and 4 cwts. dried blood . .	1	0
22	Flukes . . .	" 9	Ditto, and 4 cwts. muriate of potash .	1	0
23	Flukes . . .	" 8	Ditto, and 4 cwts. guano . .	1	0
24	Flukes . . .	" 8	Ditto, and 4 cwts. mineral superphosphate	1	0
25	Flukes . . .	" 9	Ditto, and 4 cwts. sulphate of ammonia	1	0
26	Flukes . . .	" 7	20 tons of stable manure per acre	1	0
27	Flukes . . .	" 9	Ditto, and 4 cwts. dried blood	1	0
28	Flukes . . .	" 9	Ditto, and 4 cwts. muriate of potash	1	0
29	Flukes . . .	" 8	Ditto, and 4 cwts. guano	1	0
30	Flukes . . .	" 8	Ditto, and 4 cwts. mineral superphosphate	1	0
31	Flukes . . .	" 8	Ditto, and 4 cwts. sulphate of ammonia	1	0
32	Flukes . . .	" 7	20 tons of stable manure per acre . .	1	0
33	Flukes . . .	" 7	Ditto ditto . .	1	3
34	Flukes . . .	" 7	Ditto ditto . .	1	6
35	Flukes . . .	" 7	Ditto ditto . .	1	3
36	Flukes . . .	" 7	Ditto ditto . .	1	6
37	Flukes cut out of 8 oz. sets .	" 7	Ditto ditto . .	1	0
38	Flukes cut out of 8 oz. sets .	" 7	Ditto ditto . .	0	9
39	Flukes cut out of 6 oz. sets .	" 7	Ditto ditto . .	0	9
40	Flukes cut out of 4 oz. sets .	" 7	Ditto ditto . .	1	0
41	Flukes cut out of 4 oz. sets .	" 7	Ditto ditto . .	0	9
42	Flukes cut out of 4 oz. sets .	" 7	Ditto ditto . .	0	6
43	Spencer's King .	" 7	Ditto ditto . .	1	0
44	Spencer's King .	" 7	Ditto ditto . .	0	9
45	Spencer's King .	" 7	Ditto ditto . .	0	6
46	Spencer's King .	" 7	Ditto ditto . .	1	0

made at Benthall, near Broseley, in 1865—rows all 2 feet apart.

No	Number of sets per acre.	Weight of Sets per acre.				Gross produce per Acre.				Net produce per Acre after deducting weight of Sets.				Produce per set stated in ozs.	Increase of crop in proport'n to the weight of of sets.
		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.		fold.
1	21,780	0	12	0	17¼	4	6	0	1	3	13	3	12	7.07	7.07
2	29,040	0	16	0	23	6	8	1	15½	5	12	0	20	9.30	9.30
3	43,560	1	4	1	6	5	19	3	16	4	15	2	10	4.92	4.92
4	21,780	1	4	1	6	4	12	2	25	3	8	1	19	7.62	3.81
5	29,040	1	12	1	18	5	14	1	0	4	1	3	10	7.05	3.52
6	43,560	2	8	2	13	8	8	0	12	5	19	1	27	7.21	3.56
7	21,780	2	8	2	13	5	4	2	2	2	13	3	17	8.57	2.14
8	29,040	3	4	3	8	9	13	0	13	6	8	1	5	11.91	2.97
9	43,560	4	17	0	26	13	17	3	5	9	0	2	7	11.42	2.85
10	21,780	3	12	3	19½	7	9	3	17	3	16	3	23½	12.33	2.05
11	21,780	4	17	0	26	3	15	1	11		.	.		6.20	0.77
12	21,780	0	12	0	17½	5	19	0	12	5	6	3	23	9.80	9.80
13	29,040	0	16	0	23	5	12	2	5	4	16	1	10	7.00	7.00
14	43,560	1	4	1	6	6	16	3	20	5	12	2	4	5.63	5.63
15	21,780	1	4	1	6	8	9	2	5	7	5	0	27	13.95	6.97
16	29,040	1	12	1	18	6	15	1	7	5	12	3	17	8.35	4.17
17	43,560	2	8	2	13	9	19	1	8	7	10	2	23	8.20	4.10
18	21,780	2	8	2	13	15	12	2	12	13	3	3	27	25.72	6.43
19	29,040	3	4	3	8	16	9	1	14	13	4	2	6	20.32	5.03
20	43,560	4	17	0	26	21	18	0	24	17	0	3	2	18.02	4 50
21	21,780	2	8	2	13	11	1	3	22	8	13	1	9	18.26	5.65
22	21,780	2	8	2	13	15	17	1	3	13	8	2	18	26.58	6.64
23	21,780	2	8	2	13	7	12	3	13	5	4	1	0	12.57	3.14
24	21,780	2	8	2	13	12	3	1	11	9	14	2	26	18.88	4.72
25	21,780	2	8	2	13	11	8	2	15	9	0	0	2	18.81	4.71
26	21,780	3	12	3	20	22	1	0	21	18	8	1	1	36.80	6.05
27	21,780	3	12	3	20	12	6	0	13	8	13	0	21	20.25	3.37
28	21,780	3	12	3	20	15	8	1	17	11	15	1	25	25.37	4.22
29	21,780	3	12	3	20	12	7	1	2	8	14	1	10	20.34	3.32
30	21,780	3	12	3	20	14	2	2	9	10	9	2	17	23.25	3.87
31	21,780	3	12	3	20	15	16	2	1	12	3	2	9	26.04	4.34
32	21,780	4	17	0	26	21	9	3	19	16	12	2	21	36.20	4.52
33	17,424	3	17	3	4	20	10	3	6	16	13	0	2	42.25	5.28
34	14,520	3	4	3	8	15	7	3	17	12	3	0	9	38.00	4.75
35	17,424	2	18	1	10	17	2	1	21	14	4	0	11	35.21	5.86
36	14,520	2	8	2	13	15	17	2	14	13	9	0	1	39.21	6.53
37	21,780	2	8	2	13	14	10	3	8	12	2	0	23	23.92	5.98
38	29,040	3	4	3	8	17	15	1	12	14	10	2	4	21.92	5.48
39	29,040	2	8	2	13	16	17	0	8	14	8	1	23	20.80	6.93
40	21,780	1	4	1	6	11	8	1	27	10	4	0	21	18.80	9.40
41	29,040	1	12	1	18	13	5	3	2	11	13	1	12	16.40	8.20
42	43,560	2	8	2	13	10	15	0	14	8	6	2	1	13.85	6.92
43	21,780	0	12	0	17	15	16	1	3	15	4	0	14	26.00	18.74
44	29,040	0	16	0	23	19	4	0	7	18	7	3	12	23.70	23.70
45	43,560	1	4	1	6	20	19	1	7	19	15	0	0	17.25	17.25
46	21,780	1	4	1	6	17	14	3	16	16	10	2	9	29.20	14.50

TABLE 1.—RESULTS of EXPERIMENTS on the POTATO-CROP, made at

No	Variety of Potato.	When Planted.		Manure and Remarks.		Distance in the Row.	
						ft.	in.
47	Spencer's King .	March	7	20 tons of stable manure per acre . .		0	9
48	Spencer's King .	"	7	Ditto	ditto . .	0	6
49	Spencer's King .	"	7	Ditto	ditto . .	1	0
50	Spencer's King .	"	7	Ditto	ditto . .	0	9
51	Spencer's King .	"	7	Ditto	ditto . .	0	6
52	Spencer's King .	"	6	Ditto	ditto . .	1	0
53	Spencer's King .	"	6	Ditto	ditto . .	1	0
54	Queen of Flukes	"	6	Ditto	ditto . .	1	0
55	Queen of Flukes	"	6	Ditto	ditto . .	0	9
56	Queen of Flukes	"	6	Ditto	ditto . .	0	6
57	Queen of Flukes	"	6	Ditto	ditto . .	1	0
58	Queen of Flukes	"	6	Ditto	ditto . .	0	9
59	Queen of Flukes	"	6	Ditto	ditto . .	0	6
60	Queen of Flukes	"	6	Ditto	ditto . .	1	0
61	Queen of Flukes	"	6	Ditto	ditto . .	0	9
62	Queen of Flukes	"	6	Ditto	ditto . .	1	0
63	Flour Ball . .	"	6	Ditto	ditto . .	1	0
64	Flour Ball . .	"	6	Ditto	ditto . .	0	9
65	Flour Ball . .	"	6	Ditto	ditto . .	0	6
66	Flour Ball . .	"	6	Ditto	ditto . .	1	0
67	Flour Ball . .	"	6	Ditto	ditto . .	0	9
68	Flour Ball . .	"	6	Ditto	ditto . .	0	6
69	Flour Ball . .	"	6	Ditto	ditto . .	1	0
70	Second Kidney .	"	4	Ditto	ditto . .	1	0
71	Second Kidney .	"	4	Ditto	ditto . .	0	9
72	Second Kidney .	"	4	Ditto	ditto . .	0	6
73	Second Kidney .	"	4	Ditto	ditto . .	1	0
74	Second Kidney .	"	4	Ditto	ditto . .	0	9
75	Second Kidney .	"	4	Ditto	ditto . .	0	6
76	Second Kidney .	"	4	Ditto	ditto . .	1	0
77	Second Kidney .	"	4	Ditto	ditto . .	1	0
78	Daintree's Seedling	"	3	Ditto	ditto . .	1	0
79	Daintree's Seedling	"	3	Ditto	ditto . .	0	9
80	Daintree's Seedling	"	3	Ditto	ditto . .	0	6
81	Daintree's Seedling	"	3	Ditto	ditto . .	1	0
82	Daintree's Seedling	"	3	Ditto	ditto . .	0	9
83	Daintree's Seedling	"	3	Ditto	ditto . .	0	6
84	Daintree's Seedling	"	3	Ditto	ditto . .	1	0
85	Daintree's Seedling	"	3	Ditto	ditto . .	1	0
86	Early Handsworth	"	3	Ditto	ditto . .	1	0
87	Early Handsworth	"	3	Ditto	ditto . .	0	9
88	Early Handsworth	"	3	Ditto	ditto . .	0	6
89	Early Handsworth	"	3	Ditto	ditto . .	1	0
90	Early Handsworth	"	3	Ditto	ditto . .	0	9
91	Early Handsworth	"	3	Ditto	ditto . .	1	0
92	Early Handsworth	"	3	Ditto	ditto . .	1	0
93	Lemon Kidney .	"	3	Ditto	ditto . .	1	0
94	Lemon Kidney .	"	3	Ditto	ditto . .	0	9
95	Lemon Kidney .	"	3	Ditto	ditto . .	0	6
96	Lemon Kidney .	"	3	Ditto	ditto . .	1	0
97	Lemon Kidney .	"	3	Ditto	ditto . .	0	9
98	Lemon Kidney .	"	3	Ditto	ditto . .	0	6

Benthall, near Broseley, in 1865—rows all 2 feet apart—*continued.*

No	Number of Sets per Acre.	Weight of Sets per Acre.				Gross produce per Acre.				Net produce per Acre after deducting weight of Sets.				Produce per set stated in ozs.	Increase of crop in proport'n to the weight of sets.
		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.		fold.
47	29,040	1	12	1	18	35	8	0	19	33	15	3	1	43.70	21.85
48	43,560	2	8	2	13	21	7	1	9	18	18	2	24	17.58	8.79
49	21,780	2	8	2	13	25	9	3	3	23	1	0	18	44.00	11.00
50	29,040	3	4	3	8	21	16	1	15	18	11	2	7	27.00	6.73
51	43,560	4	17	0	26	30	5	2	9	25	8	1	11	24.91	6.25
52	21,780	3	12	3	19	30	19	3	12	27	6	3	20	51.00	8.50
53	21,780	4	17	0	26	34	0	2	14	29	3	1	16	56.00	7.00
54	21,780	0	12	0	18	14	6	2	6	13	14	1	17	24.40	24.40
55	29,040	0	16	0	23	10	14	2	24	9	18	2	1	13.25	13.25
56	43,560	1	4	1	6½	15	16	0	0½	14	11	2	22	13.40	13.00
57	21,780	1	4	1	6½	14	4	3	0	13	0	1	21	23.42	11.74
58	29,040	1	12	1	18	14	19	1	1	13	6	3	11	15.80	9.56
59	43,560	2	8	2	13	17	13	1	21	15	4	3	8	14.54	7.27
60	21,780	2	8	2	13	16	17	3	15	14	9	1	2	17.80	6.95
61	29,040	3	4	3	8	19	6	3	2	16	1	3	22	23.87	5.96
62	21,780	4	17	0	26	30	5	2	9	25	8	1	11	49.83	6.22
63	21,780	0	12	0	17	10	12	2	21	10	0	2	4	17.50	17.50
64	29,040	0	16	0	23	6	8	2	0	5	12	1	5	18.80	18.80
65	43,560	1	4	1	6½	15	19	3	6	14	15	1	27½	13.15	13.15
66	21,780	1	4	1	6½	14	13	2	2	13	9	0	23	24.15	12.07
67	29,040	1	12	1	18	16	12	0	23	14	19	3	5	20.50	10.25
68	43,560	2	8	2	13	20	15	0	24	18	6	2	11	17.08	8.54
69	21,780	2	8	2	13	17	1	0	20	14	12	2	7	28.00	7.01
70	21,780	0	12	0	17	9	15	1	2	9	3	0	13	16.07	16.06
71	29,040	0	16	0	23	12	13	2	12	11	17	1	17	15.65	15.65
72	43,560	1	4	1	6½	13	13	2	21	12	9	1	14½	11.26	11.26
73	21,780	1	4	1	6½	18	6	1	21	17	2	0	14½	30.15	15.07
74	29,040	1	12	1	18	17	9	3	10	15	17	1	20	21.58	10.79
75	43,560	2	8	2	13	14	1	3	25	11	13	1	12	11.60	5.80
76	21,780	2	8	2	13	20	0	3	12	17	12	0	27	32.10	8.02
77	21,780	3	12	3	19½	26	8	2	22	22	15	3	2½	43.50	7.20
78	21,780	0	12	0	17	11	8	3	16	10	16	2	27	18.83	18.88
79	29,040	0	16	0	23	13	2	2	3	12	6	1	8	16.20	16.25
80	43,560	1	4	1	6½	14	4	2	17	13	0	1	10½	10.68	10.63
81	21,780	1	4	1	6½	14	4	1	17	13	0	0	10½	23.40	11.70
82	29,040	1	12	1	18	16	3	0	3	14	10	2	12	19.93	9.96
83	43,560	2	8	2	13	19	1	3	7	16	13	0	22	15.70	7.85
84	21,780	2	8	2	13	20	12	0	14	18	3	2	1	33.90	8.47
85	21,780	3	12	3	19½	25	16	2	5	22	3	2	13	42 15	7.08
86	21,780	0	12	0	17¼	4	12	1	13½	4	0	0	24¼	7.60	7.60
87	29,040	0	16	0	23	7	16	1	15	7	0	0	20	9.65	9.65
88	43,560	1	4	1	6½	8	17	0	3	7	12	2	24½	7.65	7.65
89	21,780	1	4	1	6½	4	18	0	18	3	13	3	11½	8.07	4.04
90	29,040	1	12	1	18	6	10	2	5	4	18	0	15	8.05	4.02
91	21,780	2	8	2	13	11	4	3	11	8	16	0	26	17.66	4.62
92	21,780	3	12	3	19½	13	16	2	0	10	3	2	8½	22.75	3.79
93	21,780	0	12	0	17¼	6	19	2	27	6	7	2	10	11.50	11.50
94	29,040	0	16	0	23	7	18	0	0	7	1	3	5	9.75	9.75
95	43,560	1	4	1	6½	7	7	0	7	6	2	3	0½	6 05	6.05
96	21,780	1	4	1	6½	6	17	2	27½	5	13	1	21	11.33	5.66
97	29,040	1	12	1	18	8	11	3	3	6	19	1	13	10.60	5.30
98	43,560	2	8	2	13	5	0	3	14⅝	2	12	1	1⅜	4.15	2.07

TABLE 1.—RESULTS of EXPERIMENTS on the POTATO-CROP, made at

No	Variety of Potato.	When Planted.	Manure and Remarks.	Distance in the Row.	
				ft.	in.
99	Lapstone . .	March 4	20 tons of stable manure per acre . .	1	0
100	Lapstone . .	" 4	Ditto ditto . .	0	9
101	Lapstone . .	" 4	Ditto ditto . .	0	6
102	Lapstone . .	" 4	Ditto ditto . .	1	0
103	Lapstone . .	" 4	Ditto ditto . .	0	9
104	Lapstone . .	" 4	Ditto ditto . .	0	6
105	Lapstone . .	" 4	Ditto ditto . .	1	0
106	Lapstone . .	" 4	Ditto ditto . .	0	9
107	Lapstone . .	" 4	Ditto ditto . .	1	3
108	Lapstone . .	" 4	Ditto ditto . .	1	0
109	Lapstone . .	" 4	Ditto ditto . .	1	0
110	French Red Kidney	" 6	Ditto ditto . .	1	0
111	French Red Kidney	" 6	Ditto ditto . .	1	0
112	French Red Kidney	" 6	Ditto ditto . .	1	0
113	French Red Kidney	" 6	Ditto ditto . .	1	0
114	Blues	" 8	Ditto ditto . .	1	0
115	Blues	" 8	Ditto ditto . .	1	0
116	Blues	" 8	Ditto ditto . .	0	9
117	Blues	" 8	Ditto ditto . .	1	0
118	Late Red . .	" 8	Ditto ditto . .	1	0
119	Late Red . .	" 8	Ditto ditto . .	0	9
120	Late Red . .	" 8	Ditto ditto . .	0	6
121	Late Red . .	" 8	Ditto ditto . .	1	0
122	Late Red . .	" 8	Ditto ditto . .	0	9
123	Late Red . .	" 8	Ditto ditto . .	0	6
124	Late Red . .	" 8	Ditto ditto . .	1	0
125	Late Red . .	" 8	Ditto ditto . .	0	9
126	Late Red . .	" 8	Ditto ditto . .	1	3
127	Late Red . .	" 8	Ditto ditto . .	1	0
128	Late Red . .	" 8	Ditto ditto . .	1	0
129	Late Red cut out of 4 oz. sets	" 8	Ditto ditto . .	1	0

TABLE 2.—RESULTS of EXPERIMENTS on the

No	W'ght of Sets.	Name of Potato.	When Planted.	Distance in the Rows.		Number of sets per Acre.	Weight of Sets per Acre.				Produce per set in ozs.
				ft.	in.		tons.	cwts.	qrs.	lbs	
1	8 ozs.	Early Prolific Kidney	Feb. 16	1	0	21,780	4	17	0	26	28.17
2	4 "	Early Prolific Kidney	"	1	0	21,780	2	8	2	13	23.21
3	2 "	Early Prolific Kidney	"	1	0	21,780	1	4	1	6	17.07
4	4 "	Seconds Kidney .	March 31	1	0	21,780	2	8	2	13	13.95
5	2 "	Seconds Kidney .	"	1	0	21,780	1	4	1	6	13.55
6	1 "	Seconds Kidney .	"	1	0	21,780	0	12	0	17½	12.45
	8 "	Flukes . .	"	1	3	17,424	3	17	3	4	30.79
8	4 "	Flukes . .	"	1	0	21,780	2	8	2	13	15.0
9	2 "	Flukes . .	"	1	0	21,780	1	4	1	6	12.0
10	1 "	Flukes . .	"	1	0	21,780	0	12	0	17½	12.10

Benthall, near Broseley, in 1865—rows all 2 feet apart—*continued.*

No	Number of sets per Acre.	Weight of sets per Acre.				Gross produce per Acre.				Net produce per Acre after deducting weight of sets.				Produce per set stated in ozs.	Increase of crop in proport'n to the weight of sets.
		tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.		fold.
99	21,780	0	12	0	17¼	14	15	3	22½	14	3	3	5	24.35	24.35
100	29,040	0	16	0	23	7	14	1	27	6	18	1	4	9.53	9.53
101	43,560	1	4	1	6½	14	16	0	13	13	11	2	6½	12.18	12.18
102	21,780	1	4	1	6½	11	15	1	24	10	11	0	17½	19.30	9.65
103	29,040	1	12	1	18	14	1	3	35	12	9	2	7	17.40	8.70
104	43,560	2	8	2	13	8	6	2	13½	5	18	0	0½	6.85	3.42
105	21,780	2	8	2	13	13	8	2	11	12	16	1	22	22.10	5.52
106	29,040	3	4	3	8	17	18	3	9	14	14	0	1	22.14	5.53
107	17,424	1	18	3	16	10	19	2	27	9	0	3	11	22.60	5.66
108	21,780	4	17	0	26	11	19	0	3	7	1	3	5	19.66	2.45
109	21,780	3	12	3	19½	4	17	0	26	1	4	1	6½	8.00	1.33
110	21,780	0	12	0	17¼	12	9	2	18	11	17	2	1	20.54	20.54
111	21,780	1	4	1	6½	14	7	2	16¼	13	3	1	10	23.66	11.83
112	21,780	2	8	2	13	13	3	1	24	10	15	3	11	22.50	5.62
113	21,780	3	12	3	19½	13	8	1	8	9	15	1	16	22.07	3.67
114	21,780	0	12	0	17¼	2	11	2	14	1	19	1	24	8.36	8.36
115	21,780	1	4	1	6½	3	17	3	4	2	13	1	25½	6.40	3.20
116	29,040	1	12	1	18	4	2	2	16½	2	10	0	26½	5.10	2.55
117	21,780	2	8	2	13	3	17	3	26	1	9	1	13	6.41	1.60
118	21,780	0	12	0	17¼	22	14	2	6¾	22	2	1	17½	37.40	37.40
119	29,040	0	16	0	23	19	0	3	8½	18	4	2	13½	23.50	23.50
120	43,560	1	4	1	6½	20	18	1	1	19	13	3	22½	17.20	17.20
121	21,780	1	4	1	6½	32	0	0	5	30	15	2	26½	52.66	26.33
122	29,040	1	12	1	18	35	2	0	26	33	9	3	8	43.33	21.66
123	43,560	2	8	2	13	34	16	1	19	32	7	3	6	28.65	14.32
124	21,780	2	8	2	13	27	17	3	13½	25	9	1	0½	45.90	11.47
125	29,040	3	4	3	8	21	12	2	20½	18	7	3	12½	26.70	6.67
126	17,424	1	18	3	16	18	6	2	7	16	7	2	19	37.70	9.42
127	21,780	4	17	0	26	38	19	2	25	34	2	1	27	64.15	8.01
128	21,780	3	12	3	19½	37	18	3	0	34	5	3	8	62.42	10.40
129	21,780	1	4	1	6½	24	11	2	7	23	7	1	0½	40.44	20.22

Potato Crop, made at Benthall, near Broseley, in 1864.

Gross produce per Acre.				Net produce per Acre after deducting weight of sets.				Rate of Increase.	Manure and Remarks. 20 Tons of Stable Manure used per Acre.
tons	cwts.	qrs	lbs.	tons.	cwts.	qrs.	lbs.		
17	2	1	21	12	5	1	23	3.52	Single rows, 2 feet apart.
14	2	0	14	11	13	2	1	5 80	Single rows, 2 feet apart.
10	6	1	6	9	2	0	0	8.53	Single rows, 2 feet apart.
9	6	3	14	6	18	1	1	3.48	Single rows, 2 feet apart.
7	17	2	22	6	13	1	16	6.77	Single rows, 2 feet apart.
7	11	1	8	6	19	0	18½	12.45	Single rows, 2 feet apart.
14	19	1	1	11	1	1	25	3.84	Single rows, 2 feet apart.
9	2	1	6½	6	13	2	21½	3.75	Single rows, 2 feet apart.
7	5	3	5	6	1	1	27	6.0	Single rows, 2 feet apart.
7	7	0	7	6	14	3	17½	12.10	Single rows, 2 feet apart.

could not be got into the ground, except by planting them so close as to be prejudical to the crop. The advantage, therefore, of large sets remains practically unimpaired.

Sixthly. Weight for weight cut sets produce, as nearly as possible, the same weight per acre as whole potatoes; but for the reasons given above, the weight of the sets should not be reduced by subdivision.

Seventhly. Smaller sets give a larger produce in proportion to their weight than the larger sets.

Eighthly. When the intervals between the sets in the rows are diminished to less than a foot, the produce of *each individual set* is proportionately diminished. Though this is not necessarily accompanied by a diminution of the weight of the crop, no increase in the produce of each individual set is caused by placing the sets at intervals wider than a foot.

Ninthly. With reference to the relative produce of different varieties, a *Late Red* sort takes the precedence throughout the experiments; and of the several varieties of Fluke, "Spencer's King of Flukes" and "The Queen of Flukes" are much more prolific than the ordinary variety.

RINDERPEST.

All immediate alarm lest this terrible scourge should be introduced to our shores having subsided, it seems a favorable time to gather what lessons we may from the experience of Great Britain for use in the possible contingency of its future introduction into this country. Such an event, however much to be deplored, cannot be deemed more improbable to-day, than was its introduction into England considered to be, by those best qualified to judge, a dozen years ago. In 1856, Prof. Simonds was sent to the continent by the three great Agricultural Societies of England, Ireland and Scotland, to investigate and report upon the disease as manifested in the outbreak then prevalent over a large tract of country. One of the conclusions to which he arrived was expressed in his report as follows: "That no fear need be entertained that this destructive pest will reach our shores." But it did reach them, and caused awful havoc, probably a thousand times more than would have occurred, had they promptly adopted judicious and efficient measures to arrest its progress; such measures as they have been taught by late and costly experience.

If these lessons are rightly apprehended, the first is, *that the immediate slaughter of all diseased animals and of all which have been exposed to infection, is not only the most effective remedy, but it is the cheapest also, provided it be adopted at the outset or early enough to give reasonable hope of success.* At the same time a rigid cordon should be placed around the infected district at a distance sufficient to include all which may have been exposed, and so, by perfect isolation, secure *an impassible barrier to its extension.* There should be also the adoption of all other precautionary measures, such as the burning, burial or thorough disinfection of whatever may communicate the germs of disease, and the administration of of prophylactics to the well.

But if the disease attains strong headway, and occupies various centres from which to extend, at considerable distances from each other, before energetic measures are instituted, there is reason to believe that a policy different in one respect may be better—to wit:—the substitution of treatment for the sick in place of the

knife. Let all such as show the slightest symptoms of disease be gathered into quarters set apart for hospital uses: let a rigid quarantine be enforced, let all the apparently well which by any possibility may have been exposed to infection, be frequently and critically examined, in a word, let all possible precaution be taken to prevent the spread of the disease. But let the sick die if they must, and get well if they can with the help of nature alone or with that of man added.

Rinderpest is believed to be a zymotic disease—i. e. one in which the germs of disease when once received into the system act like a ferment—like yeast in dough they leaven the whole lump, and convert the animal organism into a mass of disease. One of the alleged triumphs of modern medicine is the discovery that sulphurous acid (not sulphu*ric*) and also the alkaline sulphites (not sulph*ates*) these being combinations of sulphurous acid with soda, potass, &c., forming sulphite of soda and sulphite of potash, &c., will arrest this action in the living system as effectually as they will arrest fermentation in fermenting matters out of the body.

If such be really the case, and numerous observations and experiments tend strongly to indicate that it is, it follows that, if a solution of sulphite of soda (perfectly harmless) be given to a well beast, and it be then exposed in a way to receive the germs of rinderpest, *these could not begin to develope* so long as the system retains any portion of the sulphite. And there is reason to believe, that if the germs of disease had been recived into the system and had not made progress in development beyond a certain point or degree, their further action would be arrested, and the powers of nature suffice to elminate and throw off what had been received, and thus the beast get well.

From the time when the seeds of rinderpest enter the system until external symptoms of disease are manifested, is probably about one week. From the time when the animal first shows its sickness, the progress of the disease is generally very rapid; but it is important to know that several days before any symptoms are developed which are likely to be recognized by an ordinary observer, the existence of the disease may be ascertained by critical examination with the aid of the thermometer. If the disease exists there will be an abnormal degree of internal heat, and if the bulb of a thermometer be introduced into the rectum or vulva, instead of finding the heat to that of health—say from 98° to 100°

Fahrenheit, it will be found several degrees higher—say 102° or from 102° to 105°, and sometimes even as high as 107°.

There is great reason to believe that during the incubative stage, that is to say, during the term while the poison is spreading through the system and before external symptoms manifest themselves, remedial treatment may be effectual. This should be antidotal in its character,—destructive to the life of the germs of the disease. But if suitable measures be not put into operation before external symptoms force themselves upon observation, at which period the decomposition and degeneration of the blood has made great headway, the chances of success, are very greatly lessened —still they are supposed to be worth trying for.

I had proposed to myself to prepare a tolerably full account of the history of rinderpest as developed in the last few years in Great Britain and on the continent of Europe, with a statement of the symptoms and morbid anatomy of the disease and of the treatment pursued, but I find the work already done in a report from the pen of Hon. A. B. Conger to the State Agricultural Society of New York, lately published, far better than I could do it, and filling an octavo volume, illustrated with colored engravings. From this we give the copious extracts following, and which comprise a considerable share of what will prove most interesting to the non-professional reader. I do this with the more pleasure because they will be found to embrace matters of general interest to the farmers of the State, especially in the prevalent absence of familiarity with veterinary science, aside from its special reference to the subject in hand.

Before doing so I desire to add a word of caution. If we ever should be visited by so dire a calamity as the coming of rinderpest into our midst; or the coming of any fatal contagious disease among cattle, special care should be taken to *avoid a panic*. Since the importation of pleuro pneumonia into Massachusetts some years ago, we have had in this State, as we also had before not less, occasional cases of disease among cattle, sometimes taking a large part of a herd. Of many of these cases I have been officially notified, and I have visited nearly all, in fact every one where there seemed a possibility for any occasion to do so. In only one was found reasonable cause for alarm lest the disease prove contagious, and so to involve the public interest, although calamitous to the owners of the beasts. In the single case above referred to I found no panic, but, happily, a due degree of caution

and good judgment exercised by the town authorities. In a majority of the others, alarm prevailed greatly disproportioned to any occasion for it. And we may expect in proportion as panic prevails, usurping the place of due caution and sober judgment, that suitable measures will be neglected, and injudicious methods may be adopted:

"Diseases of animals are either epizoötic or enzoötic. This classification corresponds to that of the maladies which affect the human race, epidemic and endemic.

The former of each class have been defined as *dependent upon* or *originating in* some particular condition of the atmosphere, and as *attacking a number* of individuals at the same time. Thus they differ from the latter of each class, which are described as of purely local origin, at least in the first instance, and as comparatively limited or isolated in their development.

Diseases, however, that are at first endemic or enzoötic, may break out at a time when their diffusion is favored by currents of the atmosphere; when its condition by lowering the tone increases the susceptibility of the patient; or when chemical or other changes affect its normal constitution, and so develope fresh food for the local malaria. Then, these diseases become epidemic or epizoötic.

Most of such diseases exhibit this further peculiarity of developing in their course a malignant virus or miasm (perchance infinitesimal germs, with all the subtle rancor and prolific power of a fungous growth,) which spread through or float on the atmosphere, intensifying the original power of the "*materies morbi,*" whether originally local or not, and thus these maladies are *infectious*. But frequently it happens that the poison may be propagated by touch or direct application to absorbent surfaces, by inoculation or the like, and thus the disease may be not only infectious, but *contagious* also.

We do not present this distinction as disposed to cope with any of the vexed questions in the schools, but simply (as the sequel will show the Rinderpest to be capable of propagation by both methods) to guard, in the case of this disease at least, against the erroneous impression that it must be communicable, if at all, in one way or the other, and cannot be by both. Before, however, demonstrating that the great variety of observed facts do not sustain any such delusive view, it is desirable to trace the pest from

its earliest appearance to its present formidable development in Great Britain.

HISTORY.—The Rinderpest had its origin on the Asiatic part of the steppes of Russia, more, it is said, than one thousand years ago, and in the times of Charles the Great. These steppes (from the Russian word "step," signifying a desert or dry plain) are natural feeding grounds, not unlike the lands of Guienne in France, the heaths of Northern Germany, and in many respects like the prairies of the Great West. In these steppes are now roving from eight to ten millions of cattle, more than half being reserved for market as fat cattle. Though the greater part of these immense ranges is more or less arid, that portion of the Asiatic steppe between the rivers Volga and Don is marshy and generally accounted to be the local source of the infection. Be this as it may, no part of the steppes, or it is said of Southern Russia (and the same may be affirmed of the Hungarian steppes, stretching from Vienna east of Pesth) is wholly free at any time from this noxious distemper, although there are long periods when it is measurably kept in abeyance. * * * Professor Renault, president of the veterinary school of Alfort, in his memoir to the French minister of agriculture, has, after a thorough investigation, established the fact that this steppe-murrain never broke out spontaneously (*i. e.* as an enzoötic) in any country or locality but that of the Russian steppes, and, as we have before intimated, in the Asiatic part thereof.

He also asserts that its transmission to other parts of the civilized world has been directly by cattle contaminated with the poison when they left their native pastures; poison, as we may suppose, if not already brought in contact with the blood-corpuscles, at least lying ensconced in hair or on hoof, furtively awaiting the fatal lick or smell that ensures its absorption by the system. It is very easy to imagine how a virus of this sort might, on this theory, work out all the terrible ravages that have actually resulted, when we understand that these cattle are moved from their pastures in immense droves, sometimes numbering one hundred thousand, and how, as they migrate towards the southern and western borders of Russia, developing and leaving behind them poisonous excretions, they thus distribute the plague throughout Poland, Galicia and Hungary. Thence the passage to Western Europe is comparatively easy, unless the cordon has been tightly

drawn or the pole-axe vigorously swung. Thanks to such methods established by decrees at Berlin during the present century, the disease has never, when it has broken out in Poland, and sometimes appeared in Posen, Silesia and East Prussia, advanced since 1815 as far west as Brandenburgh.

In 1841 it penetrated into Egypt by cattle bought by the Pacha from Annatolia and Karamania, resulting in the desolating loss to that country of 350,000 cattle. During the Crimean war, and by the infection brought by Russian cattle into the Crimea, it was there fully developed; the French losing at Samsoun 8,000 out of 17,500 beasts, and the English 4,000 out of 10,000, a loss ranging from 40 to 45 per cent. The mortality in some parts of Europe has risen to 94 per cent., and in some localities not a single animal was saved.*

As the present apprehension of the outbreak of this plague in this country has arisen from its recent spread in England and Scotland, we will now present an outline of its rise and propagation in those kingdoms.

It is generally known in this country that the farmers of Great Britain do not raise food enough for its population. But it may surprise many to learn that the animal value of produce imported, to supply this deficiency, is estimated on very accurate data, at upwards of forty millions of pounds sterling. It is believed that the prominent items in this extraordinary expenditure consist of cattle, meat, butter, poultry, &c. Most of the beef class of imports come through Holland and Belgium. Prior to 1865 but one importation direct from Russia is known to have been made into any port of Great Britain, and this into that of London on 4th July, 1860. But indirectly large numbers of Hungarian and Galician cattle have been brought to English markets; more of late years, as the completion of two great lines of railroads, which traverse Central and Southern Germany, and connect Hamburg and Rotterdam with Vienna and Lemburg, furnish quick transit for these supplies. The immunity which England has enjoyed,

* The number attacked in the Austrian dominions was 296,000, of which 152,000 died. In 1863 it again invaded Galicia (in which country Prof. SIMONDS first saw the disease in 1857), Hungary and its dependencies, fourteen per cent. of all the cattle in those countries taking the infection, and the average mortality as given in Schmidt's Jahrbuch for 18C5 was as follows: Hungary, 65 per cent.; East Galicia, 77 per cent.; Croatia and Slavonia, 81.6 per cent.; Military Frontier, 83 per cent.; Moravia, 88 per cent.; Lower Austria, 92 per cent.; West Galicia, 94 per cent.; Burowina and Styria (in which but a comparatively small number were attacked), 100 per cent.

prior to 1865, in such importations, is traceable to the rigorous police measures established in Western Europe, and to the fact that the incubative stage of the Rinderpest rarely extends beyond a week.

But it seems that two importers of cattle, Messrs. Honck and Baker, were induced by the representations of a Mr. Burchell, who subsequently acted as their agent, and, in expectation of a profit of one hundred per cent. to make a contract with the Esthonian Agricultural Society for a large number of sheep and cattle; the latter to weigh at least one thousand pounds each, and to be delivered at Revel after the ice had broken up in the Baltic. As some of the beeves offered did not come up to the contract weight, forty-six were sent down from the neighborhood of St. Petersburg, from which the agent was to choose. These being on their arrival much bruised, having been transported in four-horse wagons, and deemed by him not fit for the London market, three experts or judges were appointed by the local magistrates to say how many were in a suitable condition to take; and thirteen were adjudged. These, with the Esthonian cattle which passed muster, made in all three hundred and twenty-two; but as one died in the yard before shipment, only three hundred and twenty-one sailed from Revel, on the 22d day of May, 1865, in the 'Tonning.' This steam vessel landed at Copenhagen to await orders whether, in view of the state of the markets, the owners desired her to proceed to London, Hull, or any other ports, and in obedience to instructions she put in for Hull; at which place she discharged, on the 28th day of May, three hundred and twenty cattle seemingly sound, and one which had sickened on the passage. One hundred and forty-six of this number were sold for immediate slaughter at three different market towns, from none of which has any disease been traced; twenty were picked out by Mr. Baker to go to Gosport for like use and with a like result. The remaining one hundred and fifty-five arrived at London on 29th or 30th day of May, were placed in Mr. Honck's lairs and sold in the Metropolitan market on 1st of June. On inquiries addressed by the Royal Commission to the purchasers of these animals, they were all sound beef when slaughtered, as far as appearances could lead such judges to determine the fact.

We turn for a moment to another lot of cattle which have been supposed to have had considerable agency in disseminating the contagion throughout England. Twenty-three head of fat cattle

were sent from Schiedam, in Holland, by a Mr. Defries to his son, a salesman in the Metropolitan market, which were sent into the market on 22d, 26th and 29th days of June, twelve of them thrice, the remaining eleven only twice. The markets of June being unusually dull, more animals than was customary were left unsold at the close of markets, and sent back to the yards where they lodged, which generally have sheddings attached, and are called *lairs*. This lot of twenty-three were placed in the lairs of a Mrs. Nichols of Islington, which adjoin the cattle yards used by many drovers bringing stock to the Metropolitan markets. As the prices offered for this lot of Dutch cattle were not satisfactory, they were, on the 2d day of July, reëxported to Holland.

On the 27th day of June, a cow belonging to Mrs. Nichols (who had at this date a herd of ninety-three, which, with sixteen or seventeen more purchased subsequently, were all destroyed by Rinderpest), sickened and died, as was supposed by the owner from poison. Two cows which on the 19th of June* were purchased in the Metropolitan market by a Mr. Baldwin, of Hackney, died of the same disease, one on the 29th of June, and within twenty-four hours after she was observed to be ailing; and the other on the 5th day of July. These three cases were attended by Mr. Priestman, a veterinary surgeon, who with a son of Mrs. Nichols brought the stomach and intestines of a cow of the latter to Prof. Simonds at the college, on the 4th of July, for examination. The Professor was also requested to inspect the herd and the premises, which he did with great care; had another animal killed, and took its stomach and appendages and some water from a well recently opened, to the college for examination. On the 9th day of July he was fully satisfied that these animals and others reported at that date had died of the same disease which he had observed in Galicia in 1857.

Twenty-one of the Defries cattle died shortly after their arrival at Schiedam, it having been observed before their departure that they were out of health. Moreover the plague was communicated to the stock of a Mr. Vandervelden, grazing in a pasture adjoining† that in which the Defries cattle had been placed; and the

* Prof. Gamgee states that the running from the eyes and nose, and the drooping and other primary symptoms, were observed in the market as early as the 14th of June, and gives the history of two Dutch cows bought there on the 19th, which went to Lambeth Walk, and communicated the disease in that neighborhood, one of them sickening shortly after the purchase.

† Prof. Gerlach states that this pasture was full one thousand paces from that in which the Defries cattle were placed.

owner of the stock contaminated in this wise had, in utter ignorance thereof, sold upwards of twenty, which were exported to Norfolk.

To return to Mr. Baldwin's stock. In twelve days after his first loss his herd of twenty animals was reduced to ten, his saving up to that time of fifty per cent. being attributable to the immediate slaughter of each animal on showing the first symptoms of the pest.

In a brief review of these statements (as it is impossible in this sketch, to give all the particulars which go to confirm the conclusion) the only animals which could have conveyed Rinderpest directly to English stock were brought into the Metropolitan market; from which those that developed the contagion earliest were sent to three places, two in England and one in Holland, where it was definitely recognized. And although an interval of nineteen days has to be accounted for, there seems to be little difficulty in accepting the theory of Prof. Simonds, that the pestilence was in its state of incubation in one or more of the thirteen animals sent down from St. Petersburg to fill out the contract of the Esthonian Society; that it was developed in the lot brought to the Metropolitan market; thence spread to Mrs. Nichols' lairs at Islington, and to Mr. Baldwin's farm at Hackney, on or before the 20th of June, and through the Dutch cattle into Norfolk early in July. Even if the impression, as communicated by the English Consul-General at Hamburg, and based upon the opinion of Mr. Schrader, a veterinary in the special employ of the Hamburg government, be correct, that the Rinderpest was developed by Hungarian cattle sent from Vienna to Utrecht early in May; this would require proof of the transmission of some of these cattle, or of others infected by them, to the Metropolitan market in order to account for the earliest observed outbreaks of the plague which we have given. If true, this theory would only show a double source of infection concentrating at a common point and thence to be diffused. Suffice it to say, that in a very short space of time from its outbreak in Islington, the Rinderpest appeared in Suffolk and Shropshire. Before the end of July it had invaded Scotland,* and by the 14th of October it had extended into twenty-nine

* Prof. Dick says that the infection in Edinburgh came from a herd of Dutch cattle brought down from London, two of which were bought by a cow-feeder named Ogg, and lodged in his byres; and that these developed the disease on the 8th of August, all the animals Ogg had dying except the *two foreign cattle*, which *recovered*.

counties in England, two in Wales and sixteen in Scotland, and resulted in six months in a loss of two hundred thousand animals, and within nine months of three hundred thousand at the lowest calculation; an enormous havoc, resulting mainly from a neglect to establish, as has been shown in the preliminary report, efficient sanitary cordons.

It is conceded that it is by no means an easy task to trace with exactitude the subtle course of a pestilence which thus dashed with rapid and fatal strides through the herds of Great Britain as it had previously held on in its mad career on the Continent. Nor less difficult does it seem to arrange and classify the various statements given as to the mediate instrumentalities of its spread. Too much concurrent testimony exists, however, of the poison being carried on the persons and clothes of attendants, diffused by excretions from the mucous surface, the skin and the bowels of diseased subjects; sometimes caught upon the wings of birds or clinging to their claws, so that falling plumes or alighting tracks might contaminate green pastures or farmsteads kept scrupulously clean—to cast a prudent doubt upon what would seem to partake only of the marvelous and fanciful. Proof may be deficient to show that in many cases the pest has been communicated, as some have affirmed, through the antennæ of flies crowding together on the glairy mucus exuding from eyes, nostrils or vagina; or conveyed on the hair or feet of horses, cattle or dogs beyond the limits of developed contagion; or by like secondary agencies, and to a locality sufficiently remote, for its spread by gradual or ordinary diffusion. Yet it is asserted on evidence seemingly beyond impeachment, to wit, on the statement of the Governor of Silesia to Prof. Simonds, that the outbreak in that province occurred in consequence of a carpenter's passing surreptitiously the frontier cordon from Galicia, in order to visit his father, and incautiously mending a manger in the cow sheds; thus communicating the seeds of the disease, which in a few days broke out in what had been prior to that time a perfectly healthy district.

Also, it is gravely stated in a communication on the nature of this disease, transmitted to Lord Bloomfield, and by him to the Home Government, that with a straw from an infected stable, half a dozen healthy stables could be infected. All such statements may be grouped together as sufficient, if not incontestable, testimony of the ready communicability of this poison by contact, and other instrumentalities of contagion proper.

But when we learn that it is also conveyed by currents of the atmosphere, as in instances where, for a distance of three miles, it was carried by a strong prevailing wind (the air being charged with much moisture) from byres where the disease existed, to perfectly healthy herds; or where, from the same causes, it has overleaped all quarantine regulations, we have sufficient evidence of its dissemination by currents of the atmosphere, and thus being propagated in accordance with the laws of infection proper. * * *

Pathology.—This branch of our subject we propose to consider under the ordinary classification of Descriptive and General, designing further to subdivide the former by treating first of the *symptoms*, or descriptive appearance of the disease as it is manifested in the infected animal before recovery or death, and next of the *morbid anatomy*, or description of the lessons revealed by *post mortem* dissections. In a few cases, taken from Jessen's Report, on the results of the inoculative methods, we have for convenience given the symptoms and *post mortem* revelations conjointly. Further historical reference to other murrains, and the consideration of their destructive characteristics as compared with the pest, will be reserved for the general discussion.

As we derive our knowledge of the symptoms and morbid anatomy of this distemper from authorities recognized as such in England and on the continent, of whom we may enumerate Smart, Wood, Simmonds, A. & J. Gamgee, Simon, Pope, Gerlach, Egan and Jessen; where there are conflicting or independent statements, we will subjoin to such the name of each authority.

Incubation.—From the time of the first introduction of the poison into the system, until the development of the external symptoms, a period elapses of several days, which is known as the *incubative stage* of the disease. The time assigned by different authorities varies considerably, though there is but little doubt that we may fix this period in the majority of cases as one of six days. This is the time assigned by Smart and Wood. Egan states it from four to eight days.

The period of incubation varies according to the mode of the introduction of the poison; where the disease is inoculated, I believe it is four or five days; but where it is caught in the usual manner, from eight to ten days. (J. Simon.)

In the inoculation cases which I have had, it has usually averaged from six to eight days, and not beyond that. It cannot be longer than ten days, if ever so long. (J. Gamgee.)

It is seldom less than seven days, and it may be extended to fourteen or fifteen days, or perhaps to a longer period than that. (Simonds.)

The period of incubation is generally from five to seven days, through in in rare cases it may be more. (Gerlach, from personal observation.)

The evidence as to the internal development of this disease in its primary stage, is drawn principally from post-mortem observations of animals slaughtered soon after exposure to the contagion, and attests the fearful rapidity with which it is absorbed. And first it is stated that within thirty-six or forty-eight hours after inoculation, the blood is so thoroughly contaminated that a single drop is sufficient to develop the disease in all its malignity when employed as an inoculative medium, though Gerlach states that blood is rarely, if ever used, as the secretions of the eyes, nose and mouth are, in the remedial agency of inoculation.

Invariably, in the early stage, even before the vulva and mouth have become affected, the lining membrane of the fourth stomach, and of the whole intestinal canal from that stomach downwards, shows appearance of disease. This is indicated by what is at first a mere blush of redness on the surface of the lining membrane, quite appreciable, however, when compared with the pale, fawn-colored appearance found in the healthy state. (Wood.)

The other stomachs soon sympathize with the condition of the fourth; the rumen or paunch, and second stomach or reticulum, are loaded with undigested food, and the third or many-plies is impacted with a mass which assumes the form of a large, round ball, and becomes, as the disease advances, a hard, dry mass.

EXTERNAL SYMPTOMS. As the incubative period declines, the primary symptoms visible to the eye occur in the following order:

Loss of appetite, exhibited first in aversion to all sorts of green food, and on the following day in indifference to food of any kind. At first the animal leaves a portion of its food, and then refuses it altogether.

Rumination. The animal now ceases to *chew its cud*, and then there is manifest

Constipation in its gradual development. The dung is of a dark color, sometimes covered with slime on its surface. [Many show signs of bellyache, by frequently looking round towards the tail and bending up the back. (Egan.)

Diminution of the flow of *milk* (much greater than in pleuro-pneumonia. Priestman.)

External appearances are, first,

1. *Depression* in looks, standing in the same posture, with drooping head and reclining ears. These, with the horns and other extremities, show a loss of natural heat.

2. The first striking signs are manifest in a change of manner. Most commonly the beast is remarkably heavy and dull, hangs its head, lowers its

ears, stays behind the herd, and when in the stable *keeps away from the crib.* (Egan.) Sometimes there is a shaking of the head to and fro. If you lift it up, *it goes down again like a dead weight.* (Ernes.)

3. Sometimes an animal will be *excited*, uneasy, shaking its head, stamping with its feet, lowing frequently, butting with its horns, and running away from the herd. If tied up in the stable, it tears away from its chain and rope, and continually endeavors to go elsewhere. (Egan.)

4. *Trembling motions* now occur of the head and neck; the hairs bristle up, especially on the back and towards the shoulders; the insertions of the horns and ears are sometimes cold, sometimes warm; the palate is dry; the eyes shining, &c. (Egan.) In the cases first observed in England by Professor SIMONDS, there were not the same nervous twitchings about them that had been observed in Galicia.

Respiration is slightly quickened, the expiration or *outbreath* is prolonged, and the pulse rises a few beats. (Smart.) Joined with a striking motion of the flanks and low groans, sometimes a short, dry cough supervenes, which is the cause of much uneasiness to the animal. (Egan.) In most cases a cough with great difficulty in breathing exists, the animal making more noise on expiration than in pleuro-pneumonia. (Gooch's account of symptoms of Dutch bullocks in Norfolk, communicated to Prof. Simonds.)

The *Vulva*, (the external opening of the vagina or passage leading to the womb) assumes a *reddish* tinge (with generally a few bluish streaks—Wood), and the color deepens as the disease advances, these appearances furnishing in females the *most reliable* and distinctive external characteristics of the disease. (Smart and Wood.)

The *Mouth* shows a faint, *red* or *purple* line on the under gum along the roots of the teeth, closing up the column of primary symptoms within forty-eight hours. (Smart.) The buccal membrane, particularly at the junction of the interior of the lips with the gums, becomes abraded or excoriated—the membrane peels off in little irregularly shaped spots, presenting a mouse-eaten or mouse-gnawed appearance. The papillæ of the tongue and cheeks are enlarged. (Per Barron, V. S., Sequel, &c.)

In the vulva and mouth we have the distinctive sign of the Rinderpest; and in the latter the appearance can be readily distinguished from that observed in epizoötic eczema or mouth and foot disease.

THE PERIOD OF CONGESTION.—This is the stage of the disease when the congestion, which has exhibited its earliest outbreak in the epithelial membranes covering the mucous surfaces of the fourth stomach and in part of the bowels, and then shown itself in the vulva and mouth, becomes active and pervades the entire system, showing in the first place a largely quickened action of the

Pulse. The number of pulsations in health may be rated at 40 to 45 per minute in the field, and 50 to 60 in the byre. The pulse now *mounts up* to

80, 90 and even 100 beats per minute (Wood); 60 to 110 (Smart.) Thirst and loss of appetite become more marked.

Respiration becomes *hurried*, and frequently labored and noisy, instead of from 18 to 20 per minute as in health, the inspirations range each minute from 40 to 60 and considerably higher (Wood); 36 to 70 (Smart.) The respirations numbered 96 in an animal which recovered, and are often *jerking* in their character. (Pope.)

Temperature of the body (externally) is *lowered* and deficient, requiring the use of blanketing, and that the temperature of the byre should be raised to 70° Fahr. (Smart.)

Vital depression is characteristic of this disease throughout its entire progress, and becomes manifest as the congestion is extending over the internal organs.

Exudations from the eyes (viscid, slimy tears—Egan), nose, mouth and vulva, form with rapidity, consisting of a glairy, ropy mucus, and indicating the extended congestion of the external membranes of these organs; those of the mouth and vagina exhibiting *apthæ*. The conjunctivæ are congested, becoming, as the disease progresses, perfectly turgid; large plugs of dense ropy mucus being occasionally passed. The alæ are more swollen and injected on their internal surface; externally copper-colored and livid looking patches are observable, about the fifth or sixth day, and in many instances a little earlier; the discharges become purulent alike from the canthi, the nostrils and the vagina. (Pope.)

An abundant yellow or bloody, stringy discharge comes from the nostrils, which gradually becomes white and fetid, and a tough viscid slime flows from the corners of the mouth, and at the same time there are found on the mucous membrane of the mouth, especially between the under lip and gums, small blisters which often cover the whole inside of the mouth; the sick beast grinds its teeth, which are now very loose. (Egan.)

The *anus* is frequently very highly *congested*, presenting the appearance of hemorrhoidal congestions.

The *urine* is now not unfrequently *loaded with blood*, and is passed with considerable pain and difficulty. (Pope.)

THE PERIOD OF RESOLUTION.—The congestion is frequently favorably resolved by nursing and judicious treatment; by the strength of natural constitution, overcoming easily at the outset the diffusion of the virus, and effecting what commonly passes for a light attack of the disease; or, as frequently happens in a pregnant cow, by the concentration of the disease, in the fœtus and uterine membranes, and consequent abortion.

In all such cases the animal begins to look cheery, carries its ears forward, begins to take food and chew the cud. The milk returns and gradually assumes its natural appearance. The distinctive appearances on the vulva and the inside of the mouth disappear very slowly. (Wood.)

The attacks (of pain, &c.) gradually subside, the skin becomes warm and remains so, appetite and rumination return, looseness diminishes, &c.

In convalescence, a scabby eruption very often appears on the skin, accompanied by itching, especially on the nape of the neck or the sides of the neck, and on the back. (Egan.) This scabby eruption, sometimes also seen on the nostrils, and frequently met in other parts of the country, has *not* been seen in more than a dozen cases that have been *treated homœopathically* in this neighborhood. (Pope.)

If, however, from the virulence of the attack, or the lack of sufficient constitutional power to resist the disease, or from neglect and injudicious treatment, the period of congestion is not relieved by any favorable indications, then follow the symptoms which result in death.

Sometimes in the natural course of the disease, more frequently perhaps from the injudicious use of irritant purgatives, the constipated state of the bowels is changed to a diarrhœic condition. The dung becomes soft and pappy, and at length liquid, not unfrequently covered with blood; it is usually voided with little effort in small and frequent passages. (Egan.) "Diarrhœa, often dysenteric in its character, or thin, watery and offensive in the highest degree, sets in, and exhaustion, accompanied by intense restlessness, follows, and death takes place from simple exhaustion. Sometimes where symptoms seem to have improved, the animal becomes suddenly more dull; the head drops, the eyes look heavier, the conjunctivæ are almost livid, the teeth are ground, the animal butts at everything within reach, oftentimes becoming furious, and suddenly dies." (Pope.)

Again; diarrhœa might set in on the second or third day, and about the fifth day it is generally fatal; but it begins by nervous symptoms, and these are so strong at times that a cow might be found dead in the morning without having been suspected to be ill at all. (Simonds.)

On the other hand, constipation is attended not unfrequently with great distention of the abdomen, becomes obstinate and aggravates all the other symptoms. Respiration is now slow, very laborious, moaning or grunting, and the pulse slow and small. The superficial membrane of the mouth peels off from the gums and lips, leaving the surface raw. A similar action occasionally takes place in the intestinal canal, resulting in a desquamation of its mucous surface in casts. In one case the entire epithelial lining of the small intestine, in a perfect tube, was passed from the bowel and has been preserved. (Smart.) The general weakness and leanness (of the body) makes rapid progress, the eyes sink in, the sight is weak, air tumors rise in the back under the skin, groans and difficulty of breath become continually more violent, the ichorous discharge from the open fundament flows involuntarily, and finally the beast cannot stand any longer, but lies on its side with its head turned, until at once, generally, between the fifth and ninth day (in very bad cases between the third and fourth) death comes on with convulsions. (Egan.)

The staring hide and and arched back are not characteristic of the Rinderpest, but of pleuro-pneumonia; but they occasionally make their appearance when the *pest* is *complicated* with the latter disease. (Smart.)

On looking at the carcass the hair is seen bristling; a whitish slime appears at the corners of the eyes and nostrils, partly dried to a bark; the hind quarters are much swollen; the mucous membrane of the bowels projecting through the fundament is of a bluish red color, &c. (Egan.)

* * * (Here follow several pages occupied with the symptoms of divers animals related in detail, which we omit.)

MORBID ANATOMY.—On the dissection of the carcass, which is considerably distended with gases, a foul smell is experienced, which has a *peculiar* odor, and which is more intensely *disgusting* as the autopsy is extended into the abdominal cavity. It is highly *characteristic*, because if once experienced it cannot be mistaken for the exhalations consequent upon the examination of animals dying from any other disease. The pathological appearances which follow are principally those obtained by Dr. Smart from dissections made at the Edinburgh Sanatorium and at Tyne Castle, of over one hundred animals. Wherever other authorities differ from Smart, we shall, under each head, note the discrepant statements, as these clearly reveal modifications of the disease as observed by Smart, depending upon differences of nervous susceptibility of constitution, perhaps of climatic influences; different habits in regard to food, diet; previous or concurrent lesions of other diseases, &c.

MOUTH, PHARYNX AND GULLET. The gums, lips, hard and soft palates, the under surface and root of the upper surface of the tongue, the upper surface of the epiglottis, as also its membranous folds and the pharynx, are marked, to a greater or less extent, by an *aphthous* eruption, which is *not ulcerous*, as the subjacent membrane is entire.* The roughened and granulated aspect, as presented to the eye, is readily scraped off and consists of *accumulated epithelium*, collecting on the surface of the membrane *around the orifices* of the follicles, and thus giving a punctated or *honeycomb appearance* resembling minute ulcers. The lesion does not extend beyond the pharynx (back mouth), into the gullet. * * *

At the fauces, there is intense inflammation with an *effusion of lymph*, the parts being dotted over with a yellowish-white pigment. (From observations in Galicia, by Prof. Simonds, in 1857.)

The buccal membrane around the teeth is ulcerated looking, and stretching between each tooth is a kind of white secretion, which is easily removed and very fetid.

THE STOMACHS. The first and second stomachs are generally loaded and distended with food, a circumstance which indicates their suspended functional activity. No change of structure is observed in either organ, and their lining

* A like eruption equally characteristic of the disease is found at the external opening (vulva) of the vagina.

membranes are not reddened or congested. *Per contra*, their membranes are friable, *infiltrated and blood spotted* here and there. (Egan.)

The third stomach or omasum, exhibits, after careful search of its folds and in about *one-half* of the dissections, irregular circular patches from the size of a pin's head to that of a twenty-five cent piece, which have bright red or scarlet margins, and in the larger patches inclose a central portion of a dirty yellow color and gangrenous appearance. This portion is slightly depressed, friable, quite bloodless, and the papillæ on its surface shrunken, especially towards the middle, but there is not any breach of substance.

The third stomach is usually full to swelling; it is sometimes firm and sometimes soft to the touch, and in accordance therewith the contents are sometimes solid and dry (often so much so as to be capable of being rubbed to powder), in cake-shaped layers, squeezed together between the compartments, and sometimes merely damp, pappy fodder.

The third stomach is affected with inflammation in patches. This inflammatory action often going on to a degree of intensity as ultimately to end in ulceration. (Simonds.) In most of the cases observed by J. Simon, there was considerably more affection of the third stomach than appears to be general, according to the German reports. The claret-colored patches and eventually sloughs were more frequent in England.

The abomasum, or fourth stomach, is reddened in the earlier stages of the disease only a little more than in health, but the color deepens as the malady progresses, and becomes dusky red with interspersed claret-colored patches. Its lining membrane * exhibits the following deviations from a healthy state: 1st. Its attachment to the muscular coat is generally loosened, and at many points destroyed. 2d. It is soft, easily breaks down under pressure, and where the change is furthest advanced, peels off as if cohering mechanically to its sub-mucous connections. 3d. Its epithelium is imperfect, and at many points quite absent, thus forming cracks on its surface. 4th. The high color of the tissue, as microscopically determined, is due, not as has been stated, to sub-mucous or intra-mucous extravasation, but to *vascular congestion* in its most extreme form; the vessels being distended to their limits, but without rupture or dispersion of their contents unless artificially produced. 5th. In some instances, generally in cases examined a few hours after death, some small ulcer-like depressed abrasions have been found. These are not true ulcers, and do not penetrate beyond the epithelium. In other instances black spots, without breach of surface and evidently due to pigmentation, were met with. (Smart.)

In simple cases, the fourth stomach is the principal seat of disease: the natural yellow or brown color of it is changed to a dark or mulberry shade; the

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* This is swollen, especially near the pylorus, and there is a singular *mottled aspect*, when closely observed, from the grayish epithelial deposit in the glandular openings. Erosions and ulceration are not uncommon. Dr. MURCHISON says: "The membrane is studded with numerous minute superficial ulcers like those erosions which are so common in the ordinary catarrhal inflammation of the human stomach." (Gamgee's Cattle Plague.)

lining membrane is *thickened* and *corrugated*, and in cases which have been long suffering, there are often patches resembling ulceration. A careful examination of this stomach proves the morbid condition not to be the result of inflammation, but depending entirely on an intense capillary congestion of the mucous coat, which is found *raised and separated* from the muscular one beneath; . . . the peritoneal covering of the stomach is generally healthy, proving the non-existence of inflammation. (Pallin.)

The rennet stomach and the thin guts always exhibit the most striking change; on the outer surface they are more or less discolored, covered with livid spots and bare places, and when cut up the mucous membrane appears dark red, and covered with a tough adhesive slimy fluid, discolored, frequently of a greenish black. (Egan.)

In the fourth stomach there is intense inflammation of the villous membranes in patches, and every now and then you see spots of ulceration. (Simonds.)

THE INTESTINES. These show a like congestive vascularity, resembling the phenomena of muco-enteritis. Dr. Murchison's observations, however, make the inflammation of the small intestines usually most intense about the middle. The minuter vessels of the small intestines are completely injected, and can be seen by the naked eye in the arborescent forms of their intricate reticulations. When the capillary congestion is complete and is passing into the stage of destructive disorganization, there is shown a very characteristic mahogany appearance. In the large intestines the principal blood vessels of the mucous folds (rugæ) are mainly and in a higher degree affected, which gives to the gut a peculiarly striped aspect.

In the duodenum we also find similar (inflammatory and ulcerous) indications of disease as well as in the other small intestines, particularly in patches; we observe now and then a tendency to ulceration or that there is *ulceration* of Peyer's glands; but it does not appear to be an *essential* of the disease in its early stages. In the larger intestines are seen similar lesions to those in the smaller, and more frequently ulceration in the apex of the cæcum. The rectum may or may not be inflamed. (Simonds.)

The vascular engorgement increases towards the terminal portion of the canal and the mucous folds of the rectum exhibit the tumid and deeply purple appearance of internal hæmorrhoids.

The entire canal of the intestines is more or less filled with fetid gases. (Egan.)

The ileum is affected similarly to the pyloric end of the stomach, thickened, &c. That intensity of these appearances recurs in the cæcum. Here the red patches are visible, varying in intensity along the course of the large intestines until they reach the rectum, which is evidently another favorite abode of the disease, which is thickened, discolored and ulcerated, in advanced stages. (Pullin.)

The whole mucous lining of the bowels is unduly soft and its epithelium imperfect. There are no true ulcerations as in the ulcerative typhoid of man. Not unfrequently a viscid fetid mucous covers the membranous surface. The

bowel is usually empty or its contents are fluid and slimy. The discharges contain bile, and are sometimes tinged with blood. Occasionally they resemble the *rice-water stools* of cholera. The feculent matter contained in the intestines (Mrs. Nichols' cow) was fluid, stinking, and of a dirty white color. (Simonds.) The ileo-cæcal valve is, as regards function, healthy, but its lining membrane, as also that of the cæcal appendage, is involved in the general hypervascularity.

There is no sloughing or invagination of the bowels, nor any desquamation of its mucous surface in the form of casts. The intestinal glands do not share to any marked extent in the altered condition of the membrane, except that they are obscured by its discoloration. They are never ulcerated, but exhibit the chronic tuberculous condition frequently met with in healthy animals. The mesenteric glands show no lesion of structure, but are bloodless and shrunken, and their lacteal vessels are generally empty.

Kidneys, Bladder, Uterus, &c. The pyramids of the kidneys are usually congested; the cortex is pale, but the structure entire. The lining membranes of the bladder and uretha, never seriously involved, present only the appearances when the organs are congested. The uterus exhibits no peculiar feature; the state of the vagina, and especially of the vulva, being *highly characteristic*, the aphthous eruption, as observed in the mouth, being apparent at the junction of the mucous membrane of the vulva with the integument.*

The labia superiorly are dry and corrugated, inferiorly coated with discharges thick and putrid, which, when removed, shows the papillary eruption of an aphthous nature. (Pallin.)

Heart, Liver, Spleen. The condition of the heart is not peculiar, but such as is ordinarily induced by many exhausting diseases. Its muscular substance is relaxed and flabby; there is no valvular lesion or structural change. Ecchymosed patches are sometimes seen on the exterior of the ventcicles. On the inner part of the heart, and on the left side in particular, petechiæ were present. (Simonds.) The large vessels and their lining membranes are healthy. The liver is of natural size, pale in color, but sound in structure. [The liver is generally friable and of a clay yellow. Egan.] The gall bladder is usually filled with bile, which is thin and of a light green color, and rarely patchy discolorations are found on its lining membrane. [It is much distended with thin, yellowish gall. Egan.] In *one or two instances* in Galicia we found ulceration of the mucous membrane of the gall bladder, and effusion of lymph into the gall ducts. (Simonds.)

The spleen is too pulpy, and breaks down under slight pressure. The pulp is composed of broken down tissue and blood cells of a very dark color. It exhibits the same condition as in exhausting fever. The spleen is generally unchanged. (Egan.)

* The mucous membrane of the organs of generation is always red, tumefied, and the epithelium undergoing changes as seen on the mucous surface of the organs of respiration and digestion. (Gamgee, &c.)

WINDPIPE, LARYNX, LUNGS AND THORACIC CAVITY. The entire mucous membrane lining the respiratory passages is reddened and highly vascular, as in the earlier stages of acute bronchial catarrh. It is sometimes nearly dry, but more frequently, especially in the smaller tubes, there is an abundance of frothy mucus, (purulent—Egan) often of a slightly red color or tinged with blood. [It often appears to be free from inflammatory action, but is covered over with layers of lymph, frequently as thin as a sheet of paper. Simonds.] The membrane is entirely free of aphthous eruption, and there are but rarely indications of an effusive or depositive inflammatory condition. Exceptional cases have been observed in Vienna, and by Prof. Gamgee, where a considerable deposit was observed in the trachea. Only one case is to be found in all the museums of Europe where there has been, as in the exudation of croup, a solid fibrinous deposit in the trachea. The air cells of the lungs in *uncomplicated* cases are healthy; any emphysematous condition being chronic and not superinduced by the disease. The lungs appear shriveled, pale or discolored, and sometimes much swollen. (Egan.) The serous membrane of the chest, as a rule, is likewise free from disease. (Simonds.)

FEET. The lining membrane* of the cleft of the hoof is very highly congested, with desquamation, &c., similar to the other external lesions of the mouth and vulva.

FLESH.* This possesses a mulberry or dark claret color, with the remarkable quality of irridescence or of changing color. The color of the fat is of a dark and dusky yellow, becoming more marked after exposure to light and air. Both muscles and fat exhibit an unusual degree of shrinkage. The muscle, however, after a period of exposure, loses the first characteristic distinction from healthy beef, and the mulberry hue is insensibly changed for a reddened tint, still with an element of brown, which imparts a peculiar duskiness to it. If the animal is slaughtered early in the development of disease, there cannot be detected any alteration in the carcass. (Higgins, 1st Rep.) Prof. Brucke, of Vienna, stated that during a recent epidemic of steppe murrain, in Bohemia, the authorities, according to their practice, had the diseased beasts slaughtered and buried; but that the populace dug the carcasses up and ate them without any injury.† Similar accounts of plenty of cases are given in Levy's Traite Hygiene. (J. Simon.) * * *

GENERAL PATHOLOGY.

(Under this head the reporter first expresses his dissent from the generally received opinion that the Rinderpest is identical with the epizoötics which have visited Europe for ages past, and after presenting his views at considerable length, goes on as follows :)

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* The great capacity of this membrane for the diseased condition, naturally leads to the inference that it is highly capable of absorbing the virus from urine, dung and other exuviæ of Rinderpest subjects, with which it may be brought in contact.

† It is to be hoped that the food thus eaten was thoroughly cooked, so as to destroy the entozoa, which have almost invariably been found in animals dying of the cattle plague, and in much larger numbers than in the cases of healthy animals.

But to proceed with the more positive share of our task. We have seen that the eruptions noticed on the flank and udder are papular, not pustular, and that in a majority of cases they appear as indications of convalescence or resolution effected through the functions of the skin; so that it is quite impossible to trace any parallel between the Pest and small pox, unless it be urged for the most fatal cases, where coma and death follow closely upon the first intimations of ailment, and the type of the former be sought in that most malignant form of the latter, known as *Variola sine eruptione*. All methods then, designed to ward off or mitigate an attack of the Pest by inoculation with variolous matter from the human subject, would, on grounds of similarity as to type between these diseases, and viewed theoretically, be condemned as empirical; a conclusion amply confirmed by many abortive trials to prove it otherwise. So too, we must treat as fanciful the opinion lately advanced, that this epizoötic should be regarded as an acute internal scarlatina; the reddened appearance of the mucous surfaces, unaccompanied by the rash, as in the human subject, presenting the only common symptom. Yet we are happy to record the fact, that no attempt has been made, either for prophylactic or curative ends, to transfer the poison of Scarlatina, into the veins of a Rinderpest subject.

Except in a few cases where vaccination may have introduced, in addition to the specific virus of the Pest, some typhoid germs, the inner surfaces of the viscera do not exhibit evidences of the degeneration peculiar to typhoid fevers, or observable in the muco-enteritis of cattle; nor do the respiratory organs reveal serious effusion, as in typhoid pleuro-pneumonia. Dr. Tucker in his report to the Lord Lieutenant of Ireland, while repudiating any theory of identity, says: 'The purple gum, the black, saltless blood, and some other symptoms of the *African* typhus, may be recognized in the Rinderpest.' Why might not a parallel be drawn also with cholera, and influenza? The answer to this and the refutation of all the fanciful conceptions to which we have alluded, is given by science, which has very recently exploded the old classification of diseases, and has grouped those which we have mentioned, with many others,* in one leading class of zymotic diseases (order, miasmatic).

* Such as chicken-pox, measles, quinsy and diptheria, croup and hooping cough, ague, remittent, continued and yellow fevers, ophthalmia, erysipelas, hospital gangrene and childbed fever, plague and carbuncle, dysentery and diarrhœa, &c.

The word *Zymotic* is derived from the Greek of *ferment*, and was first suggested by Dr. Wm. Farr to indicate that diseases, so named, manifest in their course a destructive influence on the circulating medium, approaching as near as may be to fermentation, and due to the action of specific poisons of organic origin. These, like inorganic poisons introduced into the system, are found to obey certain general laws; first, that each has a specific action, and secondly, lies latent in the system a certain though varying period of time, before its specific action is evinced; and thirdly, that the phenomena resulting from such action vary with the amount of poisonous matter taken into the system, and the receptivity of the patient.

The miasmatic order of this class, as applied to the diseases of cattle, may be understood to embrace all diseases which are commonly ascribed to *paludal or animal malaria*, all due to *specific disease poisons*, capable of propagation from one animal to another, and *communicable* either by *direct contact* or indirectly through various channels of intercourse.

It is frankly admitted that this or any classification would be valueless in the investigation of the Rinderpest, unless it be conceded that this epizoötic is wholly distinct from others, not only in its leading characteristics, but in its source or origin as a blood-poison. And it is principally in this latter sense, that we can pronounce it a disease '*sui generis*,' developed through the agency of a poisonous germ, which breeds after its own type, and multiplies 'after its own kind,' and by a process as regular and uniform as that (to use the emphatic though homely language of John Simon, medical officer of the Privy Council in his sixth report) 'by which dog breeds dog, and cat breeds cat, and as exclusive as that by which dog never breeds cat, nor cat dog.'

The seminal principle or germ of the Pest being considered then as *one* and distinct from that of other epizoötics, its varying manifestations remain to be accounted for. Its development as to time and potency is dependent upon certain spheric conditions, and the different susceptibility of races and individuals. Prof. Röll states that for many years the cattle plague hung upon the Polish frontier without entering Austria, until certain other diseases appeared among cattle and men, and then it became a general pestilence. As far as the historical records of other desolations among the lower orders of creation bear reliable testimony, this view is corroborated. It is also confirmed by the cyclical periods which,

as is claimed, mark the devastation of this plague in its native steppes.

Again, it has been too frequently observed to admit of denial, that its fatality has been less marked with those cattle, of whom it may be said that the Pest is to their manor born, than among other races. Devons taken to Russia, after thriving admirably for a time, when brought within range of this distemper, yielded under its most frightful manifestations, and in droves.

So among the cattle first seen by Prof. Simonds in quarantine at Kamienica, a neighborhood which had then been free from the plague for eleven years, were four steppe oxen, three of which recovered, one having never sickened; while of the native cattle, with whom these and six other steppe oxen were housed at this and an adjoining village, in sheds belonging to the same proprietor; thirty-one, being the whole herd in one place, died within nineteen days after the steppe oxen arrived; and of the other lot, which included the four first mentioned, twenty-eight in all; thirteen died and eleven were slaughtered.*

The power of contagion being limited or increased by the operation of certain conditions in nature which it may be difficult to define, or by varying developments of constitutional vigor (which may be equally vague in statement, though undeniable in fact) we are prepared to understand why in different climates and with different races of cattle, the symptoms and the morbid anatomy may seem doubtful or conflicting in particulars, and yet center in a common type, to mark the specific action of a specific virus.

Thus, where from any predisposing or dominant cause the force of the disease in its early incubation is expended on the membranes investing the brain (cerebellum, principally) or the spinal cord, we should expect the twitchings, nervous rigors and fury, and the consequent effusions in those regions observed in Hungary and Galicia by Egan and Simonds.

Where, again, as in the few cases referred to by Prof. Gamgee, the concentrated action of the poison is seen in the trachea and its bronchial branches; we could hardly imagine relief from this obstruction of the respiratory functions in time for any reaction on the intestinal canal. And where, lastly, the grand onslaught

* Perhaps a more marked case is given by Dr. WEBER, as occurring at Kamionka Woloska (Galicia), where 101 oxen, which were brought from Bessarabia, developed the contagion in the farmsteads in the village, so that 158 animals were attacked, of which 93 died; only *one* of the imported oxen suffered.

of the distemper was in the latter direction, we might reasonably look for lesions so much more distinctly pronounced, that what seemed only aphthous appearances in other cases might in these be imagined to be ulcerations; and glands which, in a vast majority of cases, seemed untouched, might give signs of purulent destruction. Making every reasonable allowance for different manifestations in cases such as those we have given from Jessen, where the disease was induced by inoculation; or for a predisposing tendency to the typoid state, muco-enteritis, pleuro-pneumonia and the like; we are still able to group together all the seemingly conflicting indications, and define the general scope of this disease by its *congestion of the mucous tissues*, more or less diffused, and that congestion as mainly *destructive* of the epithelial covering of these tissues.

In the incubative stage, marked changes manifest themselves in the condition of the blood, and the commencement of feverish action. We have seen that when the virus has once been absorbed, it permeates within a few hours every portion of the blood, rendering each drop a fresh medium for inoculating the healthy animal with the Pest. It would almost seem credible, that the poison is a vital germ, feeding upon the germ cells of the blood, appropriating its serous and driving off its saline constituents; and propagating its kind until the red corpuscles become amorphous and shrivelled. Gamgee, however, did not in his microscopic investigations, observe the serrated condition of the corpuscles noticed by Dr. Smart. In some cases he found "a great excess of white corpuscles, and in others delicate needle-shaped crystals, which are probably hæmato-crystalline,* form in the blood *after* this fluid has been drawn from the body."

The moment that the normal balance in the blood constituents is disturbed, feverish action, which escapes notice by ordinary means of observation, is truly established. Gamgee, reviving the use of the thermometer,† first proposed in 1754 by De Haen, a celebrated Clinical teacher in the Hospital of Vienna, as the best aid in the diagnosis of pyrexia; institued a series of remarkable experiments

* These crystals may be regarded as evidence mostly of the decomposition which the blood undergoes, and of abnormal chemical combinations of its saline constituents. They resemble closely in form and appearance those recently obtained by WORMLEY in the methods proposed by him for the discovery of poisons when found in human tissues in minute quantities.

† Also tried by Dr. SANDERSON.

in the use of one of Casella's registering thermometers. He discovered an elevation of temperature in the earliest stage of the disease, varying from one to four degrees, Fahr., "*preceding the acceleration of the pulse* and *every other symptom*."

He inserted the bulb and about two inches of the stem of the thermometer within the vagina or rectum, and kept it in place a couple of minutes. To prevent error in the use of the instrument, he adopted the precaution, between each observation, of dipping it in water (90° Fahr.) and used a few drops of Condy's disinfecting fluid for cleansing purposes. He found the temperature of these parts, when the animals were in a healthy condition, and the females not in the period of œstrum or sexual excitement, varying from 100° to 101°, rising occasionally to 102°, and perchance, in a hot day or when driven from their pastures, "one or two-tenths more" than usual. He visited, on the 17th of November, a stock of Ayrshires, at Corehouse, near Lanark, where a cow seized on the 9th had died on the 14th, a second case occurred on the 15th, a third on the 16th; and where, on cursory examination, he found six more ill. On the 18th he examined forty-two cows with a thermometer dipped in water 100° Fahr., before each observation, inserting the instrument in the rectum up to that portion of the stem marked 80°. Of this entire lot, one or two had slight discharge from the eyes; one gave more marked indications in rapid respiration, one in urine of dark brown color, and a half dozen in scanty supply of milk. The rest were eating and ruminating, giving full quantity of milk, &c.; none had diarrhœa. "The temperature was recorded at 102° in one case; at 104°.1– in another; at 104°.8– in two; from 105° to 106° in ten; from 106° to 107° in seventeen; in the rest from 107° to 107°.8–. Twenty-five succumbed by the 22d inst., and only five were living on the 25th, "in spite of careful nursing and the best medical treatment." Gamgee observed variations in the frequency of the pulse and temperature during the course of the disease, as Jessen did between the pulse and respirations; also a sudden lowering of temperature with increased frequency of pulse from 120 upwards, a few hours before death. A *gradual* decrease of temperature until it reaches the normal standard prognosticates recovery.

It seems a matter of regret that Dr. Gamgee, who has evinced in all his researches, skill and learning of the highest order, should have felt such utter hopelessness of the efficacy of remedial treatment *in posse* if not *in esse*. Otherwise we think he might have

gained another laurel to his veterinary prowess. Nothing seems to be clearer than this proposition, that if the pest is to be properly regarded as a zymotic disease whether developing its fatal germs in the blood, on and in which they feed and multiply; or by an action analogous to ferment, or that chemico-physiological action which Liebig has denominated catalysis, producing abnormal changes in the circulating medium; before the disintegration of structures (the principal test of infection in disease) is manifested: or to take a more palpable illustration, to be viewed as poison from a venomous bite, which must be instantly neutralized, or whose absorption and propagation must be arrested without loss of time that life may be saved; the treatment must be antidotal or destructive of the foreign germ-life, and attempted before the processes of decomposition in the blood have gained much headway. And to this end the use of the thermometer as afresh proposed by Gamgee is indispensable. But it is unnecessary further to foreshadow the use to which we propose to put this method in the treatment we may recommend. * * *

The science of pathology which has made such mighty strides during the last half century, has yet to search out the nature and perchance figure the form of those poisonous germs which develop zymotic disease; to give them distinctiveness by due classification and to separate or identify their action on and power over the animal economy, with those of the well known poisons of the *mineral* or *vegetable* world, especially, perhaps, of the sporules of the various tribes of fungi. The work though vast, is not beyond present hope. It has now all the preparation needed to justify the loftiest claim, and maintain the highest attitude of expectancy. The microscope which has depictured and classified the various forms of spermatozoids constituting the generative power of the divers species of the animal kingdom; which has counted the number of the dust sporules * which feed upon vegetable products useful to man and beast, and which, as we have seen, reveals to the eye the various shapes of blood corpuscles when invaded by various parasites of variant diseases, may yet so group its subtle lenses and direct their ken into such unexplored hiding places, and triumphantly parade the tiniest instruments of torture which the com-

* The sporule of the Uredo segetum, one of the most minute of the coniomycetous fungi which attack gramineous plants, has been decyphered as equal in size to 1-7,860,000th part of an *inch square*.

mon enemy of all things living employs.* While we await with becoming patience, such wondrous revelations, we are not without the analogies of nature in disease to assist and advance our investigations

Dr. Salisbury, of Ohio, in the presence of an alarming epidemic of scarlatina, inoculated himself and family with the smut of Indian corn, produced an eruption and fever similar to that of the prevailing distemper, and effectually warded off the contagion. Had he gone a step further, and ingrafted the poisonous fluid developed by this coniomycete upon a healthy structure, he would have identified or shown the disparate action of the inoculate and natural forms of the scarlet infection. We know that a pregnant heifer may, by ergotized grain, or grasses infested with fungoid growth, suddenly abort, and unless removed from her associates of the byre, the poisonous exudations from the vulva will produce like disaster upon the entire pregnant stable; leaving in the future for all such aborting from the contagious matter, less chance of carrying their next fœtal burdens to full development, than in the case of the one which miscarried under the action of the vegetable poison. So that there may be in nature a general law by which certain poisons, vegetable as well as mineral, may become potentized in their victims, and taking to themselves a more deadly virus, spread the most virulent infection. Strange as the announcement of such a doctrine, mysterious as the conversion or coöperation of such agencies may be; they do not afford so great a puzzle to the understanding, as that by which we are called upon to account for the first developed case of any contagion, whether of small pox or cholera in the human race, or of any of the deadly murrains in the bovine.

We state the difficulty which is experienced in the scientific world, without insisting upon any theory, conjectural or imaginary. It is enough to dispel existing delusions which trace the sources of contagion solely to malarious vapors or atmospherical degenerations, or again, to active animal or vegetable parasites, or to any other source than that of poisonous vitalized germs.

It is impossible to deny the vitality of pus corpuscles in ophthal-

* The most serious difficulty in the present extension of microscopic vision, which has revealed the multiplication of bacteria and low animal and vegetable organisms by powers estimated at 3,000 diameters, does not seem to lie in a further extension of micrometric power, but in the *transparency* of these infinitesimal germs; a difficulty which may soon be remedied by the ingenious adaptations of enthusiastic observers.

mia, in the public nurseries or hospitals provided for children; or of their minute offsets (revealed with wondrous power of subdivision under the microscope), as they are transported through the air, remain dormant on clothes, communicated by towels, until they reach the conjunctiva, prepared, in under-tone or by morbid process, for the supply of nutrient matter for these putrid germs. The statistics of surgical cases in our armies during the late war confirm the observations made elsewhere, that pus globules invade the system of one recovering from the primary effects of wounds or amputation, and carry him off with pyæmia.

Like observations as to syphilitic or gonorrhœal pus, the poisonous matter of puerpeal fever, or the more familiar illustration of vaccine lymph, give confirmation suited to the general mind of the theoretic views we have advanced, and which are so thoroughly supported by the researches of Prof. Boeck.

But the nature of this exotic germ-life which, when introduced into the vital economy, is the harbinger of pestilence, is not to be explained by (as the morbid germs themselves are not to be confounded with) the animalculæ observed in the dying organism. The bacteria which have been revealed by the microscope, prove only the previous destruction of tissue and its *advanced* state of decomposition; such relation being reversed, however, in the case of parasitical growths.

Should we pass over, although not precisely relevant in this connection, another condition, under which this morbid germ-life may be sustained, we should be guilty of a neglect which might result in great practical injury.

It may not be easy to prove that the germ cells of the Pest or other infectious disease can multiply in excrementitious matter as in the living body. But it would be unsafe to consider the exuviæ when kept moist and of a moderate degree of heat,* as incapable of furnishing the media for such propogation, unless we had reason to conclude that the matters thrown off by the bowels or otherwise, contained none of the nutrient matter, on which these germs of pestilence might feed, or the enveloping substances in which they might lie dormant and be preserved. For all practical pur-

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* Prof. Hertwig stated at the First International Veterinary Congress, a case where dung of diseased animals, even after it had lain in a *frozen* state for four weeks, was known to have transmitted infection. Even the water in which Rinderpest flesh (whether previously salted or not) has been washed, if drank by cattle otherwise untainted, will produce an outbreak; as will the hawking about of the flesh.

poses, and as the first law of hygiene applicable to such cases, all matters thrown off from the organism that is contending with the Pest, should be regarded as a fresh nidus of infection; unless thoroughly disinfected by chlorine, carbolic or sulphurous acids or the like. * * *

But let us bring this extended pathological summary to a close; and claim, without any further attempt to substantiate the thesis; that it is necessary, in order to embrace the various cases set forth in our earlier tracings of symptoms and morbid anatomy, and to bring unity out of their apparent diversity, to propound the following classification for the main varieties or stages of the Pest.

1. The *Congestive* or *Catarrhal Stage*, presenting the disease in its simple and uncomplicated forms, where the lesions do not extend deeper than the epithelial coat of the mucous membrane wherever affected.

2. The *Emulsive* or *Hyperæmic Stage* in which the mucous membrane is softened (more so in all probability by its own ejections lying in the concave folds of the intestine, &c.); pours forth mucin in thin form, and is sometimes in parts completely degenerated, losing its hold on the muscular coat.

3. The *Exudative Stage*, where the separation of lymph proceeds, and croupous casts or diphtheritic deposits are formed or poured out (like polypus).

4. The *Suppurative Stage*, when the follicular growth takes on a pyoid form, and granulations are attended with purulent destruction.

It is only necessary to add that it is highly probable, giving due weight and place to the evidence adduced by different observers, in various climes, and in successive outbreaks, touching the inoculative as well as natural forms of the Pest, that the largest number of cases would be found occurring and terminating either favorably or fatally in the first stage; and that the residue would be ratably proportioned among the other stages, in a ratio, declining with the advanced complications which they respectively portray.

Treatment. The treatment of a distemper so insidious in its attack, subtle and masked in its incubative stage, and if left unchecked, so fearfully fatal in its development, demands a method that shall be prompt and resolute, and based upon the calmest conclusions of science. All empirical modes should meet with a

sturdy rejection. *Blood-letting*, and the vulgar *nostrums* of farriery, should be *discarded*. The veterinary who has not thoroughly grasped by careful study the scope and action of this zymotic, should be denied a consultation or a fee. It would be better to trust to nursing and to nature than to him. For his professional blunders might, by the myriads of germs of pestilence created and diffused under his unskilful eye, add to the dumb creature his bungling destroys, holocausts of sacrifices to his quackery. It would be otherwise with the instructed and intelligent expert.

Veterinary science is now invoking to its aid the most eminent pathologists and therapeutists of the age, in order to secure the mastery of this disease. And this should not only be a cause of gratulation to all agriculturists of whatever nation or clime, and a source of hope for the future ; but it should inspire all further investigation, and the handling of every case, wherever and whenever it may occur, with the same feeling. We do not hesitate then to say, terrible as the pictures of such desolations as have been wrought in Great Britain may be, that the treatment of this pestilence in any new country it may visit, should, from its first onset, be courageous and hopeful. The arm of science thus nerved strikes always for victory. And with the facts fresh in our recollection that the Eczema which broke out in England in 1839, and the typhoid or exudative pneumonia which followed in 1841, have lost all their terrors, and can only be found in a few sporadic cases in enzoötic form ; we rejoice that the Edinburgh Committee, through Dr. Wood, their chairman, have proclaimed their faith that this epizoötic is to become milder in its type, and that its fatal ravages will be notably diminished.

Should this disease ever hold an extended reign in this country, not the knife but scientific treatment will check and overturn its empire. If the farming population, and those to whom cattle are a necessity, not only for milk, but for the purposes of labor and breeding, can be duly advised of the latter method, they will not be compelled to resort too unfrequently to the former. But it is not meant by this that science is indifferent to those wise measures of precaution embodied in salutary enactments by the legislative authority. Isolation and quarantine are an essential part of scientific treatment, and unless these can be secured, and, with other approved remedial agencies, applied skillfully and opportunely as to time ; destruction and instant burial with the use of disinfectants are the only alternatives left to incaution and ignorance.

As science cannot accept the rude instruments with which fear always urges ignorance to arm itself, so the common sense of practical men soon revolts from their long continued employment.

The proprietors and tenant farmers of Kincardshire, by memorial addressed in February, 1866, to the Privy Council, stated that until a then recent period, they were of opinion with a great majority of her Majesty's subjects—

"That stamping out by slaughtering all diseased animals, and those in immediate contact with them, was the only remedy; but that within the last few weeks a great change had taken place in your memorialists' opinions regarding this matter, in consequence of the successful treatment of the Plague in the parishes with which your memorialists are connected. . . . . &c."

After stating that on certain farms eighty cattle had been cured and only one died, and their belief that by pursuing such treatment, ninety per cent. at least might be safely brought through the dreadful Plague; they besought the Honorable Council to act under a proviso for such purpose, expressed in the Cattle Plague Act of 29 Vict., Chap. 2, and to exempt from its operation (*i. e.*, the slaughter of infected animals) for a *period of two weeks*, all cattle coming under the immediate care of the Inspector whose treatment of the disease had been so successful; to the end that if the experimental trial thus to be sanctioned should have a successful result, a like measure of relief might be extended to other districts. Strange to say, the Council refused to give a beneficent and liberal interpretation to the clause referred to, fell back upon the alleged original understanding of its purport by both Houses of Parliament; confined its interpretation to experimental cases under the direct charge of the Cattle Plague Commissioners, and refused the prayer of the memorialists. We pause a moment to remind the reader that more benign and less ambiguous provisions mark the enactments of law adopted by the State of New York on the recommendation of its Agricultural Society.

The "stamping out" process it is conceded, may effect the end it proposes within certain limits, provided these are sufficiently extended to comprehend all infected cases. But if the quarantine prove to be an imaginary one, or if the pestilence has broken out through atmospheric agencies and has extended itself beyond the limits of frontier or local cordons, then when the maladroitness of fancied security has been foiled, and all the allied antagonists to scientific methods are prostrated, this *brutum fulmen* recoils upon its abettors; and the appeal that then comes to the skill they

despised loses the full measure of benefit to have been secured at the outset, had better, not baser agencies been employed.

These are the plain practical lessons which the histories of all epidemics in the human family, and of all plagues among the brute races, clearly and invariably teach. They mark the bold uprising and clamor of empiricism, and in its successive overthrows by the strides of pestilence they point to the modest but masterly persuasions and trials of science for true and enduring relief. And if we seem to dwell upon such teachings, it is because we are conscious that as "the still small voice" followed the tempest, the earthquake and the fire, and the preparations for it was not until these fearful manifestations had awed the querulous, and doubting prophet; so it always is in the face of mortal pestilences that the howlings of terror, the onslaught of savage phrenzy and the fierce desolations of misguided zeal, precede the calm and benign intuitions of mercy and judgment, which make up what we call science, and give to it the radiance of a divine vision.

Happy are those who are saved from the period of agitation, tumult and dismay, to witness the return of serene and successful counsels and procedures. Most fortunate is the people who, anticipating this as the natural order of events wherever prejudice and passion hold their course, use all their energy and wisdom to cut short or forestall their sway, and hasten to usher in the reign of order and method.

As above intimated, we have to propose, before we conclude this branch of our subject, a method of treatment to be approved by the Society, and as we hope, also by minds versed in or attracted by scientific investigations. But before we proceed to so responsible a venture, we will pass in review the various methods pursued by the different schools in medicine, and by distinguished veterinarians and practitioners of the medical Art; and to avoid repetition, such as contribute to the scheme we may propose will not be particularly dwelt upon in this general review.

The different schools have been fertile in their inventions and modifications of the treatment pursued, whether prophylactic, hygienic or curative. Of these, the Allopathic, as the older and with a larger discipleship, is first in the order of our sketch, and of this school in Great Britain, Smart and Gamgee may be ranked as the leading authorities. In connection with the former, the Edinburgh Committee, made up of highly distinguished physicians and veterinarians, &c., deserve marked attention.

Dr. Smart, who claims to have had considerable success in the treatment of the Pest, a *summary* of which we quote from his Report to the Lord Provost and magistrates of the city of Edinburgh *in extenso*; has, after insisting upon careful and assiduous nursing, proposed three kinds of drugs as all he found requisite to employ, to wit: **Laxative*, with diuretic action—†*Stimulant* (also possessing diuretic and diaphoretic properties); and as *Tonic*, one and a half ounces of powdered cinchona bark of the best quality, to be used when convalescence is fully established. This last is given in the early period of conv lescence in combination with the stimulant, and at a later period with a quart of good sweet ale, given once daily and at night. He recommends, also, that two table-spoonfuls of laudanum be added to any of the mixtures prescribed, or combined with its food, to control excessive diarrhœa, or obviate straining.

His plan of diet requires the use of simple food, and until decided convalescence, well cooked, and given in small portions at regular hours. The *full* diet, (devised, according to Gamgee, by one of the best managers of cows he ever knew, who was in attendance at Smart's experimental byres) is composed of—

"Four handsful each of bran and brewer's draff; one pound of pease-meal; two pounds of mashed turnip (well boiled), not too thick, and given *night* and *morning*. At *mid-day* a gruel is given, of two pounds of oatmeal, well boiled in six quarts of water. In addition to these, some raw turnips (two pounds, for example, of greentops), and one pound of hay, may be allowed in small quantities during the twenty-four hours. To allay thirst, three to four quarts of water, previously boiled and allowed to cool, are given in mouthfuls during the day.‡ This constitutes the full diet of a decided convalescent. *Half* of this diet is, in most instances, during the acute course of the disease, *too much*. In all cases the same kind of food and periods of giving it are followed. There are some animals that for a time refuse all food, not excepting gruel. In such cases the gruel is administered by the bottle thrice daily, along with or after the medicine. The animal should get a little mash so soon as it takes it voluntarily. It is often expedient to miss a meal, especially whenever symptoms of an unfavorable indication appear. These are not of unfrequent oc-

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* LAXATIVE. Nitrate of Potash, Powdered Ginger, of each 1 ounce; Powder of sublimed sulphur, 2 ounces; Treacle, 1 pound; Water to make a quart, and well mixed.

† STIMULANT. Carbonate of Ammonia, ¾ of an ounce; Sweet spirits of nitre, Spirit of Mindererus, of each 1½ ounces; Cold water, 9 ounces. Mix.

‡ Many of the diseased animals evince a remarkable predilection for charred wood; and as carbon is an excellent antiseptic, it is only obeying a natural indication to supply materials to satisfy this craving. To do so, charred wood may be boiled with the water, and a few small charred branches of trees placed in the stall.

currence during the course of treatment. Grass is given, and the quantity of hay and turnip increased as there is progress toward more perfect recovery."

His summary of treatment is as follows:

1. The animal is at once taken from its ordinary food and separated from the rest.

2. It is to be placed in a well-aired byre or house free from draughts, and the temperature of which is maintained at 70° Fahr. or 75° Fahr.

3. It is to be well rubbed down, and thoroughly cleaned and covered with a good rug.

4. If there be constipation, begin with the laxative and continue night and morning, or if required, oftener, until there is free scouring.

5. Let there be no delay in giving the stimulant, and, if needful, combine it with the laxative.

6. Defer giving ale and bark until convalescense appears.

7. To obviate straining or excessive purging, two tablespoonfuls of laudanum, night and morning, may be added to other medicine.

8. Be careful to avoid overfeeding, as an error in diet may prove fatal.

9. See that the cow is well milked night and morning (even when there is no yield), during the course of the disease.

10. All the droppings should be at once disinfected by solution of chloride of lime, and quickly removed.

11. The affected animals should be frequently and closely observed, and threatening indications treated as they occur.

We give also in a note,* several examples of successful treatment, which may serve as a guide as well as encouragement to the uninitiated.

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* *First case.*—A cow from an infected byre in the Canongate, admitted on the *21st September;* was very weak, and expected to die the same night; the breathing was labored and sighing, and the animal was cold all over. Had taken no food for five days previously; the milk and cudding quite absent during that period; put under treatment next day, when it was thoroughly rubbed down and covered with double rugs. As there was already scouring, it was ordered stimulants three times a day, and to be fed entirely on gruel. It got worse apparently for two days; scouring became excessive, and mixed with blood. *On the 25th* the cow was so well as to be allowed a little mash. The temperature was good, scouring less, and there was an abundance of healthy urine. *On the 26th and 27th* there was no apparent progress; the breathing was very oppressed; pulse 100 per minute; not strength to rise; breathless and exhausted after every effort. *On the 28th* it was decidedly better; warmer, more animated, looked eagerly for the gruel; urine abundant; the dung more natural. Bottle of ale and stimulant mixture twice daily. *On the 29th* the cow eat too freely of hay; relapse of twenty-four hours, accompanied by much diarrhœa and straining; corrected by a tablespoonful of laudanum night and morning. During the next few days some progress toward recovery was made. Had stimulant twice and sometimes thrice a day, and in the evening ale with tonic powder. *On the 4th October* the pulse was 72, and getting stronger, and the respirations were 36 per minute; food consisted chiefly of gruel. Convalescence now appeared, and became decided. The cow was more lively—no scouring. Temperature good; the hide over the

The Edinburgh Committee, in their Interim Report, made up in a week after their appointment, "deprecate and strongly protest against the system of indiscriminate slaughter," &c., and regarding Rinderpest as evidently a disease of a low type, and the tendency to death to be by exhaustion, conclude that violent and lowering treatment is wholly inadmissible, &c. So also with strong saline and gastric purgatives, in the place of which Professor Dick, one of the committee, takes *linseed oil* in doses of sixteen ounces, to which is added half a mutchin (*Ang:* pint) of *whisky*. For the relief of scouring, he recommends the use of *lime water* in quart doses, to which laudanum, from one-half ounce to an ounce, is to be added. These remedies were to be followed by a *stimulant* treatment, (or it might be simultaneously administered), to wit, *carbonate of ammonia* in six drachm doses, three times a day. The tonics promotive of convalescence are, *sulphate of iron* in half ounce doses, twice a day, or the powdered *bark* recommended by Dr. Smart.

In a subsequent paper, the committee classify their treatment under four heads:

a. Diaphoretic and Stimulant.
b. Acid Treatment.
c. Restorative Treatment without drugs.
d. Prophylactic Treatment.

Under the first, a *vapor bath* is administered once or twice a day, and for successive days, according to circumstances; the animal

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back and on both sides of the neck was puffed up with air under it (generally emphysema of the cellular tissue); when struck emitted a drummy sound. *On the 5th*, unequivocal sign of advanced convalescence evinced—cudding. Two small mashes with a little turnip and grass, the stimulant mixture twice, and at evening the bark in warm ale and gruel, constitute the daily food and medicine of the animal. Milk returning; pulse and breathing natural; the cow quite recovered. Puffiness of the skin every day getting less.

Second Case.—A cow from an infected byre; put under treatment *on the 28th September;* had taken no food, nor been seen cudding for two days previously; pulse, 96; constipation and loaded paunch; vagina shewed the characteristic color; treated with laxative mixture night and morning. *On the 1st October* the pulse 96, weak; respiration 72 and oppressed. Free scouring, lasts all next day; moderated by a tablespoonful of laudanum night and morning, along with the stimulant. *On the 2d*, signs of convalescence; takes a little mash night and morning, but mostly gruel; scouring abated. *On the 4th*, convalescence more marked; pulse, breathing and temperature more natural; milk returning. *October* 7, all signs of returning health now present; takes small mash night and morning, with a little turnip, hay and grass. The milk is returning rapidly; breathing tranquil.

Third Case.—Cow from an infected byre. Admitted on the *29th September;* all the marks of the disease present; pulse 100, and weak; breathing oppressed; no appetite; very depressed and thirsty; reddened vagina and gums—constipation. Had laxative

being placed in a box or stall whose sides are an inch or so higher than the patient, covered with a tarpaulin thrown over the box so as to tightly enclose the animal except his head, and the hot vapor being kept up by throwing red hot bricks into a tub of hot water, first placed in the box below the level of the floor, and so as to be easily accessible to the operator.

The avowed object of this bath is "to promote the circulation at the surface, to relieve the congestion of the mucous membranes, and to eliminate the poison from the system."

To aid which desired results, and as not incompatible, stimulants are given:

1. *Oil of Turpentine*, four table spoonfuls in a chopin-bottle full of gruel, well shaken, and given twice a day—increasing the perspiratory effort, and superceding the use of a laxative.

2. *Infusion of Coffee*, obtained by digesting two ounces of coffee roasted and ground, in a bottleful of boiling water, for fifteen minutes, and when sufficiently cool given every six hours.

3. *Carbonate of ammonia*, administered three times a day in half-ounce doses, in a bottlefull of gruel, to which may be added three drachms of nitre.

The Acid Treatment is suggested in consequence of the alkaline state of the secretions, and consists of:

1. *Dilute muriatic acid*, three drachms, twice a day, in a bottlefull of gruel.
2. *Vinegar*, also in the gruel, two ounces, given four times a day.

The Restorative Treatment demands full accord with

1. *The general sanitary instructions* of the commission as to cleanliness,

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mixture, and freely scoured by a single bottle. To have stimulant mixture three times a day; remains in an undecided state during the next *three* days, refusing food except gruel and a little thin mash. *October* 3, the pulse 60, and respiration 48. The cow is more lively; eats a little better; same treatment; to have a tonic powder and ale at night. *October* 6, pulse still high—80; the respiration 48; the breathing oppressed; otherwise, not markedly changed. *October* 9, signs of convalescence quite decided; appetite restored, takes full meal of a convalescent quite greedily. The milk increased in quantity; improving in quality; pulse and breathing still a little too high. This arises from a slight attack of pleurisy, caught since admission to the byre.

Fourth Case.—From an infected byre. Admitted 26*th September;* taken no food for two days; dull; losing milk; oppressed in breathing; pulse 100; signs present, reddened vagina and gums. Laxative mixture given; free scouring next day; stimulant treatment; small mashes twice a day; gruel at mid-day. *On the* 1*st October*, the pulse was 96; respirations 48; temperature natural; animal dull; no appetite. *On the* 2*d*, improvement; stimulant twice a day, and ale and bark at night. *On the* 9*th*, convalescent; milk increased in quantity, improving in quality; gets full diet; takes it eagerly.

Fifth Case.—Cow from an infected byre, where ten had previously died. Admitted 1*st October*. Had all distinctive marks; treated on similar principles. *For three days*, pulse 95;, and respiration 102; nothing specially to be noted in treatment. After seven days illness, convalescent, giving full milk, chewing cud and taking full diet.

use of disinfectants, regulating the temperature of the byre so as to keep it up to 65° Fahr., or 60° Fahr. at least; the banishment of hay, straw and all kinds of fodder from the stall, as well as manger, &c.

2. *The regulation of the diet*, so as only to give oat meal or barley meal gruel, or linseed, hay and bran teas, to which, in the earlier stages of convalescence, well boiled turnips or carrots may be added; not even a handfull of hay being permitted until rumination is re-established, and that first dampened with *water* which has been *salted*.

3. *The keeping of the animal warm*, by rugs or other appliances.

4. *The use of good, sweet ale*, at the rate of two chopin bottles three or four times a day.

The Prophylactic Treatment, recommended with a view of preventing the development of the disease, or of modifying the intensity of its symptoms. &c., consists of:

1. *Sulphite of Soda*, one ounce in a bucketfull of water, and given morning and evening.

2. *McDougall's solution*, a wine glass in a bucketfull of water, twice a day.

3. *The sulphite and solution* combined, to wit, a half ounce of the first, and two tablespoonfuls of the second, given as above. * * * *

Attention was first attracted in Great Britain to the successful cure of the Rinderpest by Homœopathic remedies, through the Report made on the Cattle Plague in Belgium, by M. Barron, Her Majesty's Secretary of Legation at Brussels, to Lord Howard de Walden. In this Report, after a review of the recent outbreak in Belgium (not theretofore visited by the scourge since 1814), and which, principally from the vigorous system of quarantine noticed in our first Report, was comparatively light, the successful cures of Messrs. Seutin and Gaudy in Holland were brought to the notice of the English Government, with a strong recommendation that these gentlemen, one a chemist and the other an Ex-Professor in a Veterinary College, should be permitted to verify their practice in England. Despite the alleged malevolence of the Dutch Veterinary Corps, the carelessness of the farmers whose cattle were under treatment, and the absence of proper assistance, a large per centage (from 70 to 80) of cures was gained; the results of the practice being *officially* certified in one commune, that of Mathenesse, as of forty-six cures in sixty-three cases. The proposition of these experts being based on an indemnity moderate in amount, to cover expenses and remuneration, was not accepted by the British Government, and no opportunity was afforded for a direct inspection and test of the practice. But as appears from an address of Lord Bury, Treasurer of the Household, &c., before the General Com-

mittee of the Norfolk Cattle Plague Insurance Association, the friends of Homœopathy requested Dr. Hamilton to go to Holland to investigate and report upon the treatment pursued by both schools. The Doctor was furnished with suitable credentials from Earl Russell to that Government. He found the Allopathic practice mostly confined to the use of *dilute muriatic acid* (in doses of one or one and a half drachms), combined in linseed tea, given four or five times a day, sometimes with *gentian*, *tormentilla*, and *ginger*; occasionally recourse was had to dilute *sulphuric acid* combined with *sulphate of quinine* in equal parts. By the use of these remedies, and with the external use of *carbolic acid* in proportion of eighteen drachms of acid to forty quarts of water, or of *vinegar* and tepid water, used four or five times a day, there had been a saving of 45 per cent. The Homœopathic treatment at Matterness, within a mile of Kethel, in the very center of what had come to be styled the "black district," as reported by Dr. Hamilton, is also given by his Lordship, coupled with the allegation that the Royal Commission had refused to examine the Doctor as a witness, and the assertion of the consequent duty incumbent on the orator in common with every individual, to give as much publicity as possible to this fact.

The Homœopaths commenced their method of treatment on the 22d day of September, 1865, when eighty beasts sick with Rinderpest, as first vouched for by the certificate of veterinary surgeons, were put under their care; of which number sixty recovered. Besides these, two hundred and thirty beasts were put under Homœopathic prophylactic treatment, twenty-five showing the outbreak of the distemper before the preventive treatment had time to work; but up to the fourth week no other case had occurred, and on the 21st day of October, the commune was pronounced free from disease; the remedies employed being *Arsenicum*, *Phosphorus*, *Phosphoric Acid*, *Rhus Toxicodendron* and *Sulphur*.

Another able exposition of this method of treatment is given by Dr. Pope, from whose well digested review of the symptoms of the Pest as they passed under his own eye we have elsewhere quoted. His observations were gleaned from over one hundred and seventy cases which had occurred in his immediate neighborhood. Accepting Smart's view of the morbid anatomy of the Pest, he adopts his system of diet and care, and finds that—

"Certain features of the Rinderpest are very like those of scarlet fever. Its toxæmic character, the congested state of the mucous surfaces, and the extensive desquamation of epithelium are resemblances of some importance."

And it is doubtless because of this similarity, that Dr. Pope seems to rely on Belladonna as of prime value ; an instance being given of its efficacy, in the hands of Mr. George Hope, a much respected citizen of York, who was determined to use his best efforts, and as we judge, without any pecuniary reward, to mitigate the losses of his neighbors.

"An animal . . . . was so far advanced in the disease, that on Mr. Hope's visiting her, he found that the Inspector had been sent for, to give an order for her shooting and burial. It was late at night and as the order could not be carried into effect until the following morning, the owner was persuaded to allow medicine and gruel to be administered during the night. *Belladona* was the medicine given, and by the morning the animal had so far rallied that all thoughts of destroying her were abandoned, and she made a complete recovery."

Another exceptional case of recovery in a late stage of the disease is given, in which

"the cow was completely despaired of, when first seen, and though she suffered to a very great extent from emphysema of the subcutaneous cellular tissue of the trunk, completely recovered."

Dr. Pope very wisely recommends Belladonna, in tincture, two to five drops to be administered every two, three, or four hours. He says :

"1st, 2d and 3d dilutions were tried in our early cases, but they were by no means so satisfactory in their action as the pure tincture."

The other remedies advised by Dr. Pope with their corresponding indications we will give in his own words; remarking that they substantially correspond with those recommended by The Association for the trial of the Preventive and Curative Treatment in the Cattle Plague, &c., &c., of which His Grace, the Duke of Marlborough is announced as Chairman :

"*Arsenic* has been useful chiefly in meeting the prostration about the fifth or sixth day. As a prophylactic I question its value. If it have any, it is not in the sense that vaccination is prophylactic to small pox ; but it simply acts by keeping the animals in good condition, and so enables them the better to resist the contagion, giving rise to the disease.

"*Rhus tox.*—The chief indication for this remedy has been found in the muscular twitchings which characterize the disease in some of its stages.

"*Mercurius sol.* has been found valuable when the mouth has been long congested, and the patches of desquamation are general.

"*Ammonium caust.*, 1st dec., is of service where there is much abdominal distention, with heavy breathing and painful moaning.

"*Turpentine*, 1st dec., has been of signal service in checking hæmaturia, a symptom which did not yield to Cantharis at all.

"*Secale cor.*, tinc., Mr. Emerton thought useful in one case of subcutaneous emphysema, and its proving shows that it deserves attention in this condition.

"*Phosphoric acid*, 1st dec., *Mercurius sol.* and *Arsenic* have appeared to control the diarrhœa more than any other remedies; but they have not proved altogether satisfactory. In any future case I should be disposed to try Muriatic acid or China. It has been a more difficult symptom to meet than any other.

"*Mercurius cor.* 1, has checked several cases of dysentery in very marked manner.

"In one case of apparently impending metastasis, the acetate of copper, in grain doses of the first trituration, appeared to prevent its development; but it was the only case in which it was resorted to, and therefore much additional experience is required before its value here can be estimated correctly.

"In addition to medicines, much good has accrued from exposing the animal's muzzle to steam from boiling water or scalded bran. The nasal discharge is thus promoted, and large lumps of coagulated mucus are passed, to the great relief of the patient."

In brief review of this method of treatment, it is to be observed in all frankness, that inasmuch as the present foundation of the Homœopathic system lies in its Symptomatology, no little difficulty must be experienced in applying it to the dumb creation. Besides, the drug-provings which have been made on the human race, cannot with any certainty, or in some cases, even of probability be transferred to the brute races. This is more especially true of the ruminant orders, whose complex arrangement of the digestive organs would render the disparity of symptoms relating to the functions of assimilation, and of the reflex action upon the brain and cord from the direct influence of drugs acting upon the stomachic apparatus, more than probable. No such result might however be expected, when once the influence of the drug was felt, after it had been absorbed and entered into the blood circulation. Besides, as in this disease the function of the first and second stomachs is quite suspended, and medicines carelessly administered (especially in large quantities) and thrown into the paunch, are as inert as if lying in their original packages; so it might happen in the administration of different drugs to obtain their provings, that different results would follow if these were thrown into the first or fourth stomach. And after all, what could we know of their symptomatic indications so pregnant of suggestion in the various morbid states of the human subject, derived from provings on a

nervous expanse, not only so delicate as to register at once every, the most trivial departure from the normal state, but so secure and protected in such registry as to confirm it by an unequivocal and audible tell-tale;—what could we know except by the loosest inference, when we seek the same intelligence from those to whom nature denies the power of speech. Hence, we are thrown upon the more tardy method of watching our provings of medicaments introduced into the system of any animal, by experiments on those doomed to slaughter, or massing the drugs, and leaving the proving to go on until death supervenes. So that not only as Dr. Pope remarks—

"Any nicety in the selection of a medicine to meet a particular case, seems well nigh impossible."

—but all our reliable knowledge of the various scope of drugs irritative or destructive of nerve or tissue, alterative of the blood structures for a brief period, or exerting power until the full measure of poisonous disintegration is established, must be principally gained from *post mortem* observations.

We are not to be understood, however, as holding the view that in drug-provings on the lower races, there can be no symptomatology. We only insist that in the case before us, that of the ruminant tribes, it must be extremely limited, and that before such knowledge can be extended, a very elaborate system of drug-provings upon these tribes should be first instituted. * * *

We have yet in reserve, as before announced, the consideration of those remedies, for which it has been claimed that they severally exercise a specific influence in arresting the peculiar ferment of the Pest. Incongruous as the list may seem, they admit of an easy and scientific classification, and may be arranged in three classes:

1st. Those which are essential or concomitant elements of blood-food, and which may be exhibited to supply the waste of these elements during the progress of the distemper; these as opposing forces may be regarded as anti-catalytic.

2d. Those which may be supposed to set up a new ferment supplanting the morbid one, and thus act as apo-catalytics.

3d. Those generally known as antiseptics, which arrest the putrefactive process, by rendering the fluid or tissues, in and on which the ferment is operating, incapable of putrescence—or even of fermentation; and are thus a-catalytic.

In the first class, as it is not our purpose to refer to those which are ordinarily embraced under the head of hygienic preparations; further than to say that Dr. Smart's method of preparing and exhibiting food for the sick animal meets every contingency which the most skillful and assiduous nursing could provide against; we will note a few instances, of which the most important is the *Chloride of Sodium*, or common salt. This chloride is found in the blood, gastric juice, urine, bone, cartilage, &c. It exists also as a necessary element of vegetable food; seeds and grain containing the smallest amount, while green vegetables and meadow grasses (especially *Lolium perenne*, or common rye grass) hold it in largest proportion. The common experience, of those who are engaged in the rearing of domestic animals, is familiar with the necessity of an artificial supply of this element of the blood, in order to obtain their highest perfection , to secure thrift in growth, or even the appearance of health. Boussingault's experiments are very happy and instructive. He took six oxen and divided them into two lots;—to the one he gave salt at stated intervals, while he entirely refused it to the other. No perceptible difference in the appearance of these lots was, on the most careful scrutiny, manifest at the end of fourteen days; but at the close of the month it was revealed to the most unpracticed eye. In both lots the skin under touch was sound and fine; the hair of those, to whom salt had been supplied, was smooth and shining; of the others dull and staring. At the end of a year the hair of the second lot was matted, or *in places* had fallen out, and the animals were listless and inanimate, while the first lot had the sleek and fine coat of stall-fed beasts, and proved their high condition in frisky and rampant attitudes. It seems strange on first thought to learn besides, that the supply of salt had exercised no influence on the quantity of flesh fat, or, again in other trials, of milk obtained; but the marvel disappears when we understand that salt plays no part in the flesh forming economy, but, according to Liebig, merely neutralizes

"the injurious action of the conditions which must be united in the unnatural state of animals fed or fattened in order to produce flesh."

A clearer statement is, that

"salt serves in the organism to assist and promote the general changes without taking a share by its elements in the formative process."

It appears that a chemical action takes place in the system, by which chlorine (not found in chemical combination in any organ-

ized part or tissue, but ever present in every fluid of the body) leaves its base (sodium) in the common salt supplied to the animal, and unites with potash forming the chloride of potassium; the soda set free uniting with carbonic acid, and forming the carbonate of soda.*

Time will not suffice to follow these changes as far as chemical and physiological research has carried them; it may suffice to add that the chlorine derived from salt, and uniting with the salts of potash, is found as a principle inorganic constituent of the muscles; that the soda as an oxide is found in the secretions of the liver; as a carbonate in the blood of the herbivora (although the ashes of their food yields hardly a trace of it), twice or thrice in excess of the carbonate of potash;† while all excess of salt furnished is carried off rapidly in the secretion of the kidneys. It is important to note that the carbonate of soda (found also in the saliva) imparts to it as well as the blood their alkaline properties; that the tendency of this carbonate (as also that of potash) is to maintain the fluidity of the fibrine and albumen of the blood, that it assists in preserving the form and consistence of the blood corpuscles; and also performs an analogous function with reference to the other semi-solids of the body.‡

When we consider that all vital phenomena, or manifestations of those actions which take place in the body in a condition of health; though they may be said to be primarily dependent upon the organic nitrogenized elements of the tissues or fluids for the power of appropriating materials for their nourishment, or of self-regeneration to repair waste; are still, if secondarily, yet as essentially dependent upon the inorganic constituents of such tissues and fluids in order to keep up their play, and so maintain health and life; we find but little difficulty in concluding, that when any of the proximate principles, or elementary constituents, organic or inorganic, are in excess, or in deficient supply, their harmonious motions are disturbed, and the charm of vital play and healthy action is broken. The elements, which by too large supply in the

* Soda unites also with Oleic and Margaric Acids (the acids found in fat), forming the Oleate and Margarate of Soda, which are found in minute quantities in the blood, bile and urine—and with Pneumic Acid (the acid found in the lungs) forming Pneumate of Soda, which is not discharged from the body.

† In the milk of cows four and a half times (according to Berzelius), and six times (Pfaff and Schwarts) more than in human milk.

‡ Flint's Physiology, pp. 36 and 44; supporting Liebig's view, *ut sup.* p. 426.

first instance, or by the deficiency of their coördinates, and in the effort of nature to maintain a just equilibrium become so, must remain as clogs upon vital action, until they are thrown off, or agencies employed to restore the balance. And it is in this view that Liebig, in commenting on the condition of those animals which in the experiments of Boussingault were deprived of salt for a twelvemonth, is both convincing and eloquent, when he says that their bodies were

"in regard to disease, like a fireplace, heaped with most inflammable fuel, which only requires a spark in order to burst into flame and be consumed."

If the inquiry should now be deemed useless or visionary, whether those animals who succumbed so easily to the Pest had been denied or not a proper modicum of salt; or whether this agent was of any specific worth in the treatment of the murrians of the 17th and 18th centuries; one conclusion will not be gainsaid, that in all future prophylactic and remedial treatment of the Pest, salt should be largely supplied in the food, and in the absence of other remedies might be relied upon as palliative if not curative.† * * *

It is our purpose to treat in the second class only of *yeast*, which has been said to have been successfully tried as a remedy for the Pest; and our view of it as a remedy will be chiefly by way of comparison.

Yeast deports itself in the presence of many agents and reagents, as the ferments of zymotic disease are believed to do, and may in this respect be regarded as their type. As familiar as the common mind is with this substance, its scientific definition may not find such ready discernment. It is a compound of nitrogen in the state of putrefaction or eremacausis (slow combustion or decay), possessing the power of causing fermentation in sugar or non-nitrogenized organic bodies, of which sugar and starch are the commonest instances, and carbon the chief constituent. The presence of water is necessary to sustain its power of exciting ferment, and this is lost under pressure, or when the yeast is desiccated and dried.

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† As illustrative of the frequent agreement of the tentative experiences of instinct in our race, and the deliberate conclusions of men of science it is not improper here to notice the fact that the Indians of this Continent, whose nomad life impelled them to the chase for the sustenance of life, and limited their supply of food to that mostly deficient in salt, should have used salt successfully as a cure for the bite of the rattlesnake.

It is alone its soluble part, however, that possesses the property of inducing fermentation, and this only after it has received oxygen from the atmosphere to which it must be first exposed. It then developes in its mass carbonic acid. Like vaccine or purulent matter—if not kept dry too long, and under attendant circumstances which ensure its own decomposition—when again moistened, it starts afresh on its destructive mission.

The fermenting process is easily carried forward to putrefaction in bodies containing nitrogen, of which, in the animal organism, blood is the *primum mobile*. And as nitrogen has so low an affinity for the simple bodies, that it is said to be in a state of indifference to them, its evolution is always attended with an easy transposition of atoms. When acted on by alkalies, by acids, or increase of temperature, organic compounds, containing nitrogen in the presence of water, throw off all that element in the form of nitrates; but if the azotised animal matter first moistened, be exposed to the action of the oxygen in the atmosphere, then in the form of ammonia. When gluten, the vegetable equivalent of albumen, is subjected to the putrefactive process, after the evolution of carbonic acid and hydrogen commences, the ammonia takes on its forms of phosphate, acetate, caseate and lactate, which are produced in large quantities; so that for the time being the decomposition of the gluten ceases. But if water is freshly added, the process is renewed, and then in addition to the products just mentioned, we have carbonate and hydrosulphate of ammonia and a mucilaginous substance coagulable by chlorine, &c. Those who desire to follow the labyrinthine changes of which nitrogen is capable, will find that subject elaborately treated by Liebig, from whom we have freely taken the views above expressed. We must turn, however, to the brief consideration of the agencies by which fermentation is arrested.

These are embraced in a long catalogue known as antiseptics, of which we may mention the most important; to wit, boiling water, alcohol, salt, an excess of sugar, the mercurial salts, nitrate of silver, volatile oils; the mineral, pyroligneous, sulphurous and carbolic acids.

"Alcohol and common salt, in certain proportions, check also all putrefaction, and conseqently all processes of fermentation; because by these means the putrefying body is deprived of a certain condition of its decomposition, namely, the presence of a certain quantity of water."

The action of these antiseptics, in arresting yeast ferment, and also the putrefactive process in animal substances, is of the highest interest in the pathology and treatment of zymotic disease, and will readily furnish to the enthusiastic student of medicine most valuable suggestions. His aim in their applications in medical and veterinary practice, will be to select such as will produce the least disturbance, transient or permanent, on the vital force. We will only add, from the similarity of the action, while in the state of propagation, of yeast and morbid poisons, and the identity of the means by which it may be arrested, that it is not improbable that yeast may exert a curative action in the Pest; though even such probability requires that more numerous trials should be successfully instituted than those previously noted.

The old school of medicine has long since exhausted its ingenuity in the use of mercurial salts and the like, in the treatment of epidemics, and has passed from the general use of the mineral acids; and the present school rejoices in the discovery of the efficacy of those last named in our list, to wit, sulphurous and carbolic acids.

This brings us to the consideration of two of the most valuable antiseptic remedies; which are embraced in our third division of specific agencies.

The farmer has long been familiar with the fact, that if he burns a little sulphur in a barrel which has been rinsed out with water, and confines the fumes produced, so that they are absorbed by the wet surface of the staves, the cider he may subsequently pour into the vessel, will remain sweet for a long period and will not undergo the fermentation ordinarily induced. This preserving power is one of the attributes of the *sulphurous* (not sulphuric) *acid* generated in the combustion of sulphur, and has been taken as the starting point for some exceedingly ingenious researches by Dr. A. Polli, of Milan. This learned professor adopted the catalytic theory of disease, as applicable to those maladies in which the blood having absorbed some poisonous morbific germs, undergoes marked constitutional changes; and though he was met at the threshold of his investigation by the dogmatic assertion of the celebrated Bernard, that any substance capable of destroying a catalytic poison in the blood, would so affect that fluid, that it would be thereafter incapable of vital function; persisted in his inquiries, until he satisfied himself that not only did sulphurous

acid possess this power, but that its compounds with soda, lime, or magnesia whether hyposulphites, simple sulphites, or bi-sulphites also exercised the same function, and could be exhibited in large doses and with perfect impunity. Two animals of the same kind, size, and condition, and fed alike for a few days, except that one received a certain amount of a sulphite in his food, were slaughtered; when it was discovered that the latter gave evidence of the existence of the drug in every tissue, organ, and secretion; and furthermore, remained perfectly fresh though the weather was that of summer in a tropical clime; while the former, to which no sulphite had been given, rapidly passed after death into an advanced stage of decomposition. This experiment being confirmed by many others equally satisfactory, the deduction naturally followed, that as no fermentation could exist in the presence of a sulphite, and as this remedy could be administered without any injury to the vital function, and permeate every part of the living structure, that it was only necessary to saturate the systen with a sulphite, in order, either to prevent, or arrest the catalytic action in all zymotic maladies.

But further to establish this deduction by facts, the Professor next selected two dogs of equal size and weight, and in perfect health; fed and treated them alike for four or five days, except that to one was administered a certain quantity of the bi-sulphite of soda. Some very fœtid pus obtained from an ill-conditioned ulcer was then injected into the femoral veins of each dog (about a drachm to each), the experiment being repeated on the next day. After the first operation, both laid down, refused food, and remained prostrated for twenty-four hours. The effect of the second injection was more marked. They were seized with stupor, their pulses were rapid and feeble, and their respiration greatly accelerated; when made to rise they tottered and reeled across the room. The one to whom the bi-sulphite had not been given grew worse, his wound in the thigh became gangrenous, and in ten days he died with all the symptoms of typhus; while by that time the other, receiving his daily dose, and having regained in four days his appetite, was entirely well.

Like experiments have been conducted in a vast number of cases by the Professor and his compeer, Dr. De Ricci; sanious matter from ill-conditioned and phagedenic sores,—defibrinated blood exposed to the air until it has become putrid—the discharge from

the nostrils of glandered horses—have been employed, and in all cases proved fatal without—and wholly innocuous with— the concomitant use of the sulphites. Conversely De Ricci has exhibited the bi-sulphite in an alarming case of septicæmia, produced by a lady's kissing the lips and face of a dear friend who had died very suddenly; giving nearly twenty grains of the bi-sulphite in infusion of quassia, &c., every half hour at first, and then every hour; and with the most perfect success. Since that time the use of the sulphites has been extended to cases of scarlatina; measles; phlebitis, originating from the stinging of the back of the hand by the spines of a cactus; the malignant epidemics of the Northern Coast of Africa; puerperal fevers, &c. *

In most if not all these diseases, the administration of the sulphites has also proved *prophylactic.*

When the fermenting process is arrested by sulphurous acid, the rationale of such action, according to Liebig, is, that atoms of oxygen are taken up from the liquor of ferment, and combining with those of the sulphurous acid, form *Sulphuric Acid.* If this transposition in inorganic, is also realized in organic fluids, and takes place during the administration of the sulphites in zymotic diseases, the resultant acid being formed in very minute quantities and generally distributed throughout the circulating media, could not exert its ordinary local effects, which are primarily escharotic and destructive of the tissues. Indeed, Pereira's statements in regard to the constitutional action of all mineral acids may be adopted here, that they become neutralized by combination with bases (of salts), and are not absorbed as free acids which operate topically only. In this view we may be spared any extended discussion of the constitutional disturbances produced by the use of sulphuric acid; and for the further reason that its lesions do not correspond with those of the Pest.

The Sulphite of Potassium develops in the treatment of zymotics, action equally beneficial with that of the like salt of soda. It is more expensive, and for that reason not so well fitted for general use. Nevertheless, it should be employed as we may recommend in experimental trials; and in all desperate and long neglected cases, where it is probable that the salts of potash have begun to leave the circulation.

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* Dublin Quart. Journal, August, 1864; Glasgow Medical Journal, October, 1865.

Carbolic Acid sometimes called *Phenic Acid,* but chemically, *Phenic Alcohol,* or *Phenol,* is said to occur as a natural product in the secretion of the beaver, *castoreum,* whose peculiar odor is that of this acid ; it is also found in the oil of *coal-tar.* Its aqueous solution has an acrid taste, and an odor like that of wood smoke or creosote, of which last it is probably a homologue.* As it is highly poisonous, it is to be administered with discretion, and largely diluted with water. In this form it is very valuable as an application to the skin, where wounds and sores reach a putrescent stage,† and like the sulphite of soda, thus dissolved, is readily absorbed. The latter so diluted and applied with a wet bandage, we have known to discuss the formation of ordinary boils; the former of erysipelatous swellings. Whether this acid will act as readily or more effectually in arresting the Pest-ferment than Sulphurous acid, in its administration through the sulphites, time and experimental trials will best determine. * * * *

As a guide to the unskillful—a hand-book also to the learned—we will indicate our proposed method of treatment in a series of rules.

RULE I.—In apprehension or in the presence of an outbreak of the pest,

a. Apply the thermometer (see p. 205) to the vulva or rectum ; and if the heat of the parts (the females not being in a state of sexual excitement, and none over-heated by driving, &c.) rises to 102 deg. Fahr.; or—

b. If no such instrument can be readily had or reliably used ; observe the appearances of the inner mouth. If to the eye or by the aid of a magnifying glass there appear small round nodules (knobs) no larger than a millet seed, red at the point or head, or some of them broken and discharging a yellowish or yellowish-grey matter, and the thin membrane which covered the swelling and those adjoining peeled or rolling off: ‡

All animals exhibiting these signs are at once to be put under treatment as in Rules II, &c.

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* Silliman's Chemistry (Organic by Hunt), § 789.

† Also in the treatment of compound fractures of bones and in burns, as recommended by Prof. Lister ; and in the treatment of burns of the first and second degree, by Prof. Pirrie, &c.

‡ Those who apply the thermometer in time will SAVE THE WHOLE PERIOD OF INCUBATION, or or least *five days of burrowing* of the pest-germs through the membranous tissues, and of their ferment in the fluids of the body. Those who watch the first signs in the mouth may save from *two* to *four* days. Those who are so indolent or inobservant, as to wait until they find the disease in full blow, should "go fartner and fare worse." Let them hunt up other indications which may serve to alarm them. We have no patience for such a task.

RULE II.—*a.* Let all such animals be *separated* at once from the herd, and placed in an out-building which is to be used as a *hospital*—in suitable stalls or boxes—from which all hay, grass, straw, litter, loose dirt, cobwebs, &c., are to be removed. Sawdust, tan bark, or dry sand is to be their bed.

b. Dissolve 2 oz. of *Sulphite* (not sulphate, which is Glauber's Salts) of *Soda*, or 1 oz. of the *Bi-sulphite*, in 12 quarts of pure spring or clear rain water.

(If the treatment of the case has been long deferred, or the outbreak be deemed an alarming one, double the quantity of the salt may be employed, not otherwise). Administer 1 pint of this solution every hour (or half hour), after Gamgee's plan.* A tin twisted cup in the shape of a horn, with its mouth well rounded off, is to be employed to the *exclusion* of glass bottles. "The operator should go up to the right side of the animal, pass his hand over the face into the angle of the mouth in the left side. The head is bent round, not elevated, except to a slight extent; .... the person giving the draught to plant his feet well on the ground, with his back against the animal's shoulder, ... and holding the horn in his right hand, pour its contents by degrees into the animal's mouth."

c. Take one-half (6 qts.) of the solution as above, and add to it 12 qts. of warm water (120 deg. Fahr.), so that the mixture when used may be at least ten degrees above blood heat.† Take a coarse cotton sheet, folded to four thicknesses, and wetting it with this warm solution, (wringing the edges of the folds so that the water will not drip), lay it on the middle of a coarse woollen blanket (previously fitted as to size, and with straps to fasten it, &c.); then apply to the abdomen and fasten the blanket over the back. (Apertures may be made in the blanket if long enough, so that the hind as well as the fore legs may not be restricted in their motions, and so as to protect the chest and buttocks from the air).‡

d. If no Sulphite or Bi-Sulphite of Soda can be procured, *or more than one* animal is to be treated, use *Carbolic Acid*, 4 drachms to 12 quarts, pursuing the same method of internal as well as external treatment as in (*b* and *c*).

e. For *like* reasons as in last rule, employ 1 oz. of *Aqua Ammonia* to 12 quarts of water, as in (*b* and *c*), or,

f. 1 pint of alcohol with as much salt as it will hold in solution as in (*b* and *c*), or,

g. 1½ quarts of vinegar saturated with salt as in (*b* and *c*), or,

h. Other remedies, the specificity of which is to be proved by the same methods.

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* Cattle Plague, p. 98.

† This temperature will meet the requirement of the fourth law of absorption by osmose as laid down by Matteucci in his fourth Lecture on the Physical Phenomena of Living Beings.—Am. Edit., p. 89.

‡ As the object of this application is to induce endosmose of the saline solution by the abdominal organs, and *not* a general perspiration, the blanket must not be too tightly secured.

i. As an independent experiment with the sulphite of soda (or if the sulphite of potassium can be had, with it also), 20 gr. powders might be thrown every hour under the tongue, to be dissolved in the saliva which is rapidly secreted and then to be swallowed.

Rule III.—If the symptoms do not indicate that the ferment has subsided, twelve hours after the medicinal draughts as prepared have been entirely taken, or if they recur, commence anew with a fresh portion of the remedy selected, and proceed as in Rule II (*b* and *c*).

Rule IV.—*a.* If nervous twitchings or the like make their appearance, apply pounded ice in a bladder or bag, to the base of the brain and the spinal cord (from between the horns for a few inches along the neck). If this application does not soon relieve, and the Homœopathic treatment is preferred, in the choice of intercurrent between the doses of the anti-septic remedies, as above to be employed; give 10 drops of the tinct. of Belladonna in four table spoonfuls of water, or if the Allopathic methods are chosen, and *diarrhœa* has supervened, add a table spoonful of laudanum * to a pint of starch emulsion (or warm water) and inject as an enema into the rectum.

b. If after twelve hours from the commencement of the treatment, symptoms of aggravation appear, the dose may be doubled. Oberwise if evidence of improvement appears, it may be less in quantity and given at longer intervals.

c. When it appears desirable to remove the bandage from the bowel s, the portion of the body wet by it may be gently dashed with water from the well (60-70 deg. Fahr.), then rubbed perfectly dry, and the body covered with a fresh blanket so to exclude the action of cool air,

d. If the bandage is not used, still the animal is to be covered with a blanket, and the temperature of the stall kept not lower than 60 deg. Fahr. If the covering is sufficient, fresh air may be more freely admitted.

Rule V.—*a*, When the patient gives signs of hunger, dilute milk or boiled gruels (as in Smart's method,) to which a free allowance of salt has been added; or when thirst is manifest, water from which all chill has been taken, may be given a half hour before the administration of the medicine.

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* It would be useless to give morphia or opium in any of its forms, while a medicinal endosmose is being instituted—as it is well known that these first check and then reverse the process. They can be exhibited only when the morbid osmose has filled the bowels and brought on diarrhœa. If the brain conditions indicate the use of opium in coma, stertorous breathing, and upturned eye and contracted pupil (or a pinched eye), a warm solution should be applied and rubbed in, along the face or the under part of the neck, or one-half of a grain of morphine, or 5 grains of first decimal Homœopathic trituration may be thrown in under the tongue. It will be readily admitted as unwise, in the present state of our knowledge, to hope for the alleviation of symptoms by putting opium in any of its forms, in the stomachs, while they are in a state of suspended activity. Otherwise we admit, if scientific experiments could show that when the normal endosmosal current towards the stomachs had completely ceased, opium could exert an antagonistic power, and renew the current.

b. Should any unpleasant odors arise from the body, breath or droppings, dilute sulphuric acid may be added to a small portion of chloride of lime, and after the early escape of chlorine, and when the caustic smell of lime is perceived, the vessel is to be removed; and the contents, added to the droppings of the sick beasts, also to be removed, and covered with six inches of earth. Or carbolic acid may be used in dilute solution, and the sides and floor of the building sprinkled with it. And so with any disinfectant, such as carbolate of lime, sulphate of iron, dissolved in water, &c. Carbolic acid may be dissipated through the building by throwing from time to time a few grains of it upon a hot plate—dipped for a few minutes in boiling water and then wiped dry.

c. If constipation show itself so as manifestly to make the animal uncomfortable (and not otherwise), give two quarts of an injection of blood warm water, to which a couple of tablespoonfuls of salt have been added.

d. Should any disposition to swelling (emphysema) show itself along the back from the beginning, make the wet bandage large enough to go around the trunk; if it be only partial, or occur at a late period, shift the bandage, &c.

e. If any viscid or glairy secretions from the eyes, nose, mouth or vulva begin to flow, the parts are to be frequently bathed with a weak solution of carbolic acid, or with vinegar to which an equal portion of water has been added.

RULE VI.—The *sequelæ* of the disease must be treated according to *their indications.** If the medicines have not been pressed with too much activity, there need be but little apprehension of any violent reaction on their use. And if no such reaction manifests itself, the animal is *best left* to the "*vis medicatrix naturæ.*"

RULE VII,—*a.* When convalescence is established, the diet as given by Smart may be followed. Before being admitted to the herd, the patient should be carefully washed with a weak solution of carbolic acid, into a stronger solution of which the feet first washed out in the clefts very carefully have been allowed to stand for a time. After this operation a quarantine of seven days would be advisable.

b. To cleanse the premises, *boiling* water may be sprinkled frequently and copiously over the stalls, floors, &c. If cold water is employed, the common washing soda of the shops should be added, and all boards, &c., carefully scrubbed. The clothing of attendants may be treated in either of the above ways, or may be washed with water to which carbolic acid has been added, or they may be hung up in a barrel, and sulphur slowly burned under them, &c.

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* The constitutional disturbances produced by the force of the disease—perhaps also by the remedies—may require further medical treatment. This must be determined according to the preferences of the practitioner and the methods of the school to which he belongs. The foregoing pages may prove a sufficient guide to indicate which medicines in especial contingencies cover the case most completely.

This method of treatment will, we trust, be received by candid minds as fulfilling our pledge, not to commit it obsequiously to the interest or dogmas of any school. It will be doubtless considered in this respect sufficiently catholic. In the variety of agencies offered in Rule II, opportunity is offered to determine experimentally which is most efficacious. If the so called antiseptic remedies prove their superior virtue, they will furnish additional proof that this zymotic acts as a true ferment. If *ammonium causticum* takes the lead, it will afford another illustration of the Homœopathic law. If the absorption through the wet bandage (and we would like to see isolated trials of this method), should work successfully, this would draw just attention to the practicable adaptation in disease of the law of endosmose, and would ameliorate the heroic use of the water treatment.

In conclusion, whichever of these remedial methods should give the greatest percentage of cures, would best indicate the selection of a prophylactic agent; though we imagine that even the use of this would not excuse the farmer or stock-grower who did not, in the presence of this epizöotic, give to his cattle at least their ordinary quota of salt, as often as twice a week."

Before leaving the subject of cattle disease, some statements should be made regarding several forms now or recently existing, near enough to us to be matters of serious concern.

PLEURO PNEUMONIA. It is now generally known that the fatal contagious disease known as Pleuro Pneumonia existed in, and, to a considerable extent spread through, the milk distillery stables of New York and Brooklyn before its direct introduction into Massachusetts by means of the Dutch cattle imported by Mr. Chenery, from Europe. This fact was stated in my report for 1862, (p. 205,) and an instance was related where it had been carried (150 miles) to Albany and had destroyed fourteen out of a herd numbering thirty valuable animals, and was stayed only by the most efficient and judicious treatment. It was known also to have gone out in several other cases. For several years little has been heard, among us, of losses occasioned by this disease until very recently.

Prof. John Gamgee, of the Albert Veterinary College, London, now on a visit to this country, who has been commissioned to investigate the subject, says in a recent communication to the press, that he has "traced the malady in New York, New Jersey, Pennsyl-

vania, Maryland, District of Columbia, Virginia, and has heard of its manifestations in Ohio and Kentucky."

The fact that it is abroad should induce in Maine farmers, not alarm but *caution*, and *caution of a quiet, deep-seated, chronic type.*

Pleuro Pneumonia doubtless had a beginning somewhere, and somehow, and at some definite time, but the evidence is sufficient that it never originated under the conditions which prevail here. There is no more reason to expect its spontaneous development in New England, than to expect an earthquake to swallow up the people, or a deluge to drown them all. If it comes here it will be brought here; and it can be easily brought, for it is one of the most insidious of diseases and lies dormant (in the incubative stage) for a considerable, and as yet uncertain, length of time.

Spanish Fever. In other sections of the country an entirely different disease has prevailed, and with very fatal results. It is popularly known as Spanish Fever, and seems to follow the track of Texan cattle as they are sent northward, themselves being rarely or never affected by it. The general impression where it has prevailed is, that the Texan cattle contaminate the pastures whereon they feed, and the roads over which they are driven, and the steamboats and cars in which they are transported, by their dejections.

How it is that these cattle communicate a disease of which themselves exhibit no appearance, is not known. One supposition is that it is due to the change of climate, another that it is due to ill-usage, and it is alleged that when these cattle are driven or conveyed leisurely northward the disease rarely appears; but when hardly driven, or hurriedly pushed along by steam and rail, with the cruel accompaniments so frequently attending such conveyance, such as crowding, thirst, fright, rough treatment, &c., it developes with rapidity and violence.

Prof. Gamgee says,* "Many thousands of these cattle were driven from Texas very early in the spring and reached the western prairies just as the grain was in the best condition for their support. Here Southern and Western cattle were mixed, and with the almost invariable result of the latter beginning to die within forty days after eating grasses upon which the Texan cattle had trodden, and continuing to die until as many as ninety and ninety-five per cent. of the animals subjected to the same influence had

* In the same communication above referred to.

succumbed. No plague ever committed greater havoc than this one over the area of its development."

I have not witnessed this disease, but from the best information I could obtain from those who have seen it, and have carefully observed the morbid appearances after death, it bears a close general resemblance to the cases spoken of in my report of 1866, occuring in York two years ago; the chief difference being that in the Spanish Fever the spleen and kidneys are somewhat more implicated. The usual symptoms are rapid and feeble pulse, from 60 to 120 per minute, high fever—labored breathing, usually short and quick, loss of appetite, loss of cud, head drooping, when standing, and, when lying, the nose thrust hard upon the ground —sometimes turned back over the side, and pressed against it; the ears drooping, back arched, flank hollow, hind legs drawn up under the body; frequent knuckling over of the hind fetlocks; disposed to lie down and get up again, which is done with difficulty. When made to move, it is often with a staggering, unsteady gait. The coat rough and staring. Frequent twitchings of the muscles appear about the shoulders and other parts of the body.

A post mortem examination shows almost uniformly a healthy condition of the first three stomachs, but the fourth is intensely congested at its upper end, and in nearly all, erosions of the lining membrane. Generally the intestines are much inflamed throughout their whole extent. The gall-bladder, and liver are more or less affected, the spleen greatly enlarged, of a dark color, and structure broken up. The kidneys exhibit a similar aspect.

A report being expected soon from the Commission specially appointed to investigate this disease, in connection with which we may also expect suggestions regarding remedial and preventive measures, it seems inexpedient to enlarge farther upon the subject at this time.

THE HAY TEDDER.

One of the greatest improvements of modern times in securing the hay harvest is the introduction of the "Tedder."

The office of this implement is to thoroughly expose the mown grass to the drying action of the air. This it does in such a manner as to accomplish, at the same time, several desirable ends. Not only is the saving of labor great but the hay is better cured, especially when the crop is a heavy one. Its action throws the grass upward, allowing it to fall lightly and loosely, so that the air circulates freely through it. Consequently, while being rapidly dried, it is, to a considerable extent, dried in the shade, and goes to the barn in better condition than if longer and more fully exposed to the sun.

To a limited extent this implement has been used by the farmers of Maine, and were its value better known and its aid properly appreciated, its use would be greatly extended.

Two "tedders" are in the market,—possibly more,—but these are all I have witnessed in actual operation. Several others have been shown at various agricultural exhibitions, recently, but of their merits or demerits it were premature to express an opinion at this time. The one known as "Bullard's" was introduced five years ago or more; the "American" more recently. Last July (1868) I had an opportunity of seeing both of these in operation on the farm connected with the Cumberland Mills, in the town of Westbrook. Bullard's had been in use on the farm for several years. Deeming it expedient, however, to have two, the American was obtained this year. Both did good work, satisfactory work; in very heavy grass Bullard's perhaps more uniformly did thorough work and somewhat more of it, as its width was considerably greater; at the same time it required more power than the "American" and more frequently needed adjustment or repairs, as the strength of the machine seemed inadequate to the amount of work it was designed to accomplish. A high degree of satisfaction was expressed with regard to both; and the remark was made to me that if compelled to dispense with either the mower or the tedder,

The American Hay Tedder. Ames Plow Company, Quincy Hall, Bost... M...

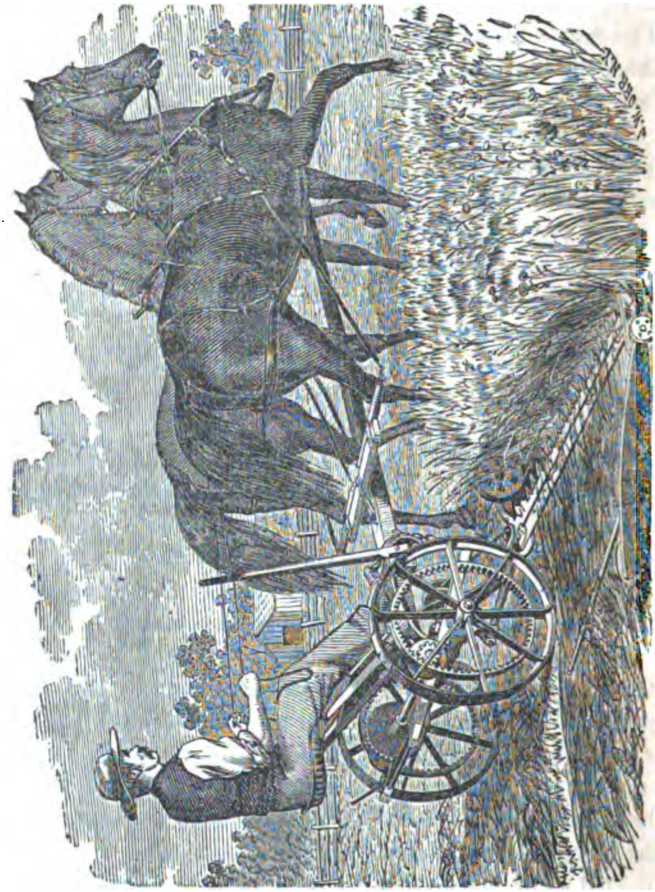
it would be hard to say, whether the loss, by reason of the deprivation of the one or of the other, would be the lesser one. To be deprived of either was an evil not to be submitted to except upon dire necessity.

A thoroughly practical and very judicious farmer (Mr. S. S. Whitman of Herkimer County, New York,) whose acquaintance I made some years ago, and who has used the tedder from about the time of its first introduction, lately expressed himself as follows:

"I think the hay tedder stands squarly in utility by the side of the mower; and that its labor-saving value is comparatively a small part if the farmer will use it to the best advantage; for by its use the hay will be from one to five dollars per ton better in quality. The mower saves hand labor, but I think no one pretends that it improves the hay. The following maxims I have not heard disputed; that the sooner grass is cured, after it is cut, the greener and better the hay,—that the more it is tedded the sooner it is cured,—that the sooner it is cured and in the barn the safer it is from dews and storms. I claim that the tedder, thoroughly and properly used, will pay for itself sooner than the mower. It is claimed by good farmers in this vicinity that no man, young or old, can ted hay as well as the improved tedder, and that a dozen men can do it no faster. When grass is cut with a mower it lies very flat and close to the ground; consequently the sun can only dry the surface, and the air has little chance to pass through it; therefore the under side remains as green for a long time as when first cut, if there be a heavy crop. By tedding immediately after mowing it is placed in a much better position to be dried by both sun and air; and the more it is cured by the air, and the less by the sun, the greener is the hay. Let it be understood that I here mean grass which is cut while yet green, and before the stalk becomes woody and of comparatively little value. My method of tedding, and which has given the best satisfaction, is to start the tedder when the piece of grass is about half mowed, so that we have the whole tedded and lying up loosely by the time the mowing is completed. We then ted again before dinner, and once more about two o'clock, if we think best. By this method the green grass dries very quickly and we get hay of excellent quality. When hay has been wet by showers the tedder answers an admirable purpose; and I predict that it will not be many years before the tedder will be deemed as indispensable on the farm as the mower."

In our report for 1859 a large space was devoted to consider-

ations relative to the various grasses, and to the ways and means of securing the hay crop, universally admitted to be the crop upon the success of which the prosperity of the Maine farmer chiefly depends. The tedder was there mentioned, and statements were given from several eminent cultivators who had used it. At that time the tedder was known only as an implement lately imported



WOOD'S MOWING MACHINE.

from England, and one which gave fair promise, especially if its construction could be simplified and its requirement of power for draught be lessened, of coming into general use. The years which have intervened have witnessed the improvements desired, and the fulfilment of the promise. The tedder is perhaps as widely known to-day as the mower was then.

A glance over the paper above referred to, also brings to mind

other changes which have taken place relative to the aids generally employed in the hay harvest.

We note that only two of the mowers there mentioned as extensively used, or as being prominent candidates for public favor, continue to hold a place as general favorites at the present time. One of these, the "Buckeye" won a high position at an early date and has kept steadily along, retaining public confidence in a remarkable degree. The other, "Wood's," subsequently became the subject of great improvement, both in the arrangement and perfection of its parts, and in strength of construction; and rapidly rose to high favor, not only in the United States but in Europe also; and at the late Exposition at Paris carried off the highest honors. Without asserting its superiority over all rival machines, it may be pertinent to say that, more of its successful and satisfactory working has fallen within my observation than of any other, and that I deem it worthy of public confidence.

With the exception of these two, all which were then figured or described, have either dropped out from general use among us, or have reappeared with essential modifications, and under new names.

The meteorological phenomena of the year present some marked features. The early part of the season was wet almost beyond precedent; planting was unusually delayed, and, at one time, the prospect for abundant harvests was not flattering; but the harvests proved better than the promise, and upon the whole, it has been a year of general prosperity to the agricultural interest.

Sheep husbandry is passing through one of those temporary depressions, which to greater or less extent, affect all kinds of business; and it needs whatever of courage can be gathered from considerations of general utility, and of the special advantages of this branch of husbandry, together with the assurance that rise succeeds fall, to sustain the resolution of owners not to part with their flocks. In very truth this is a bad time to sell good animals, but an excellent time to weed out the inferior ones.

The prospect for the future of agriculture brightens. There is a more general feeling than ever before, among the people at large, that this is a State of immense natural resources, and of resources which have been permitted to remain dormant altogether too long. Railroads are being pushed with energy into new sections, and the facilities for transport and inter-communication will soon be largely increased.

The fact that public attention is being drawn to our unrivalled water-power, is one fraught with deep interest to the farmer. A diversified industry furnishes the best of all aids to agriculture. No art thrives alone. We are members one of another. Wherever the farmer can exchange the surplus products of his soil and of his toil at the least distance from his farm, for the greatest amount of goods needful for comfort and welfare, there he may thrive better than on richer soils and under sunnier skies with customers and helpers at longer distance.

It is my firm conviction that nowhere, upon fairly striking a balance between the advantages and drawbacks of various locations, can the place be found, where the farmer may comfortably secure to himself and those dependent on him, more of intrinsic and permanent value, or contribute more to the public welfare, than in the State of Maine. And it is pleasant to feel assured that

a similar conviction is steadily growing in the minds of its inhabitants generally.

The year has been marked by events of significance and importance which deserve mention here; and the first to which I allude is the fact that the State Agricultural Society has resumed active operations. For the first time since 1860 it has held an exhibition, and it was one which proved a full success. With an empty treasury and without aid or promise of aid from the State, (uniformly granted in previous years,) it went forward, offering its premiums conditioned upon future pecuniary ability to meet the payments, and its officers labored unweariedly, and at great personal sacrifice, to insure success. The evidence furnished by this exhibition, of substantial progress in the various departments of agricultural and mechanical industry and skill, was most emphatic and exceedingly gratifying.

Another event has transpired which may constitute an era in the history of agriculture in Maine,—namely, the entrance of the "State College of Agriculture and the Mechanic Arts" upon its actual work of educating and training young men for the industrial pursuits of life. A class of highly promising young men has been gathered; less numerous, it may be, than in some similar institutions in other States, but considerably more so than the earlier classes which entered what is now the oldest, the most numerously attended and the best equipped of our literary colleges. Sufficient evidence that the necessity of more practical education is deeply felt throughout the community, is to be found in the fact of the increased attention given to it by all our educational institutions; and especially in the recent establishment of a School of Technology, or in other words, of Science applied to the Arts, including agriculture, in connection with Bowdoin College, and which has already three professors engaged in its work.

Is not the prospect highly encouraging that, as a "liberal and practical education of the industrial classes" begins to be supplied, both the facilities for teaching "such branches of learning as are related to agriculture and the mechanic arts," and the applicants for such instruction, may be greatly multiplied?

It is respectfully submitted that the name most frequently given, in common parlance, to the "State College of Agriculture and the Mechanic Arts," namely, "The Agricultural College," is partly a misnomer, or at least lacks descriptiveness, and tends to hide the full

scope and intent of that institution. The true intention of the colleges endowed by act of Congress, was *to aid all branches of industry;* those which labor to convert crude materials into forms of utility, as really as that which produces food from the soil; and it is a matter of regret that the mechanics of Maine have not evinced a more active interest in the movement, and asserted the right which is their chartered privilege.

It is undoubtedly the conviction of many staunch friends of the college, that so grave an error was committed in its location, that it must necessarily labor under serious disadvantages which might as easily have been avoided, (unless the location be changed, which may not be practicable now,) and they may also believe that some of the measures subsequently adopted were not as wise as might have been; but allowing the correctness of these views and that the errors are irrevocable, all this furnishes no reasonable ground whatever for indifference to its prosperity. If we may not have all which was hoped for, we do well to be thankful for what we may have, and pray and labor for more. Feeble as the best, compared with what is expected from it, this institution needs the coöperation of all, and the hearty and earnest endeavors of all to enhance its ability and its efficiency.

May not the time be propitious for inaugurating somewhat more of system, and harmony of action between the various agencies established among us for the aid of agriculture? To a considerable extent these are, all of them, educational in their scope and effect. The State Agricultural Society together with the County Societies, being chiefly executive in their character, labor by bringing together for comparison and illustration, for example and emulation the best products of the soil, of the workshop and the household. The Board of Agriculture, a deliberative body, by its investigations, discussions and publications, labors to gather and diffuse knowledge. These operate more upon adults, while the influence of the College is more exclusively and directly upon the youth; but the end in view, with each and all, is substantially the same.

Without offering any details, or even any general plan, it has seemed to me that the suggestion was worthy of consideration.

But agriculture can never attain its true position as an art, nor make the substantial advances which will place it alongside other industrial avocations in this progressive age, until we do more than merely to gather and to diffuse existing knowledge. *We*

need positive increase of knowledge, fully as much as we need to impart and diffuse generally what is already attained.

Let us look at this from a practical point of view. Upon how many points of every day practice are opinions widely dissimilar? Take a familiar example, potato culture; a matter touched upon in the preceding pages. Can any thing be apparently more simple and easily ascertained than what sized tubers, and whether cut or whole, is it best to plant? Yet put these questions to a hundred farmers who have planted potatoes and dug potatoes from boyhood up, and the chance is, that you will get nothing like uniformity in the replies. That some of them are mistaken, is as certain as that of three different ways of doing a thing, each cannot be the best way, yet they have arrived at their opinions by experience and observation, but upon such observation and experience only as have fallen to their lot, and these are insufficient data upon which to form a fixed conclusion, in a majority of cases. How then can such questions of practice be decided? I answer, only by a sufficient number of carefully conducted trials; and trials, in which, so far as possible, all sources of error are avoided, and these trials repeated year after year, until conclusions are reached, which, so far as the nature of the case admits, carry the force of mathematical demonstration. Who, among us, can spare the time in the busy periods of planting and harvesting, and possesses the inclination and the ability and the means and the perseverance necessary to conduct such a series of experiments to successful issue? I see not how any one can read carefully the report of one hundred and twenty-nine experiments made in one season, as given on pages 160 to 180, and their results, without feeling assured that they furnish an exceedingly valuable contribution towards such exact *knowledge* as is wanted in the place of mere *opinions*.

If the indications given by these experiments are verified by further trials of similar extent, conducted with equal care and precision, as I believe they would be; (every potato weighed, every distance measured, products weighed and no guessing any where,) and if, as a result of such knowledge, the potato crop of Maine were increased ten per cent., how much would that increase the annual income of the State?

Suppose that the 70,000 farmers in Maine, on an average, plant only one acre each, and dig a hundred and fifty bushels? If so, the crop would amount to upwards of ten millions of bushels, and ten per cent. of this would be one million of bushels; and these

would sell for more than enough to endow an institute for original investigation such as cannot be found in the United States to-day. If such gain may be a probable result of the substitution of actual knowledge in place of opinion concerning a single item of procedure in the culture of one esculent root, for one year, what may not be expected from similar knowledge in relation to the whole range of agricultural practice?

It is a mortifying fact that no more facilities have been provided, anywhere in the United States, for original investigation. As the case now stands, if we would know what progress is making, not in the application of knowledge and mother wit to the mechanic arts, but in *real additions to agricultural knowledge*, we are compelled to send abroad for the information, and to remain in debt for it.

Experimental stations, as they are called, exist in Germany, plentifully too, compared with the paucity here, and as there conducted, are very nearly what we need. But in America, so far as I am advised, the only institution, *a leading object of which*, is "*to increase knowledge among men*," is the Smithsonian; and for this we are indebted to a foreigner!—and of this it may be said, without disparagement, that however important the researches there inaugurated and supported, and however valuable its contributions to science, comparatively few of them relate to agriculture and these remotely and indirectly.

S. L. GOODALE,

Secretary of the Board of Agriculture.

JANUARY 20th, 1867.

APPENDIX.

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Amount received from the State during the year.	Amount raised by the Society during the year.	Whole amount of receipts for the year.	Am't of premiums offered in accordance with direction from Board of Agriculture.	Amount awarded on the above named offers.	Total amount of premiums offered.	Total amount awarded.	Incidental expenses of the Society for the year.	Whole amount of disbursements for the year.
Androscoggin,	297 00	591 45	888 45	75 00	13 00	678 25	352 50	513 04	865 54
Acton and Shapleigh,	130 50	348 71	479 21	32 75	18 25	238 25	381 75	18 25	400 00
East Oxford,	93 00	96 23	189 23	47 00	3 00	223 00	132 00	30 70	176 00
East Kennebec,	-	1,869 00	1,869 00	-	-	475 00	185 00	95 00	1,822 00
East Somerset,	88 38	254 45	342 83	15 00	-	434 90	215 15	137 40	328 23
Franklin,	138 45	353 02	491 47	33 00	-	434 25	325 90	150 02	475 92
Hancock,	376 00	702 45	1,078 45	100 00	-	807 00	538 00	100 00	928 00
Knox,	228 50	504 76	733 26	84 00	43 00	587 25	444 40	-	-
Kennebec,	164 50	377 06	541 56	45 00	25 00	634 50	586 50	288 60	875 00
North Kennebec,	235 50	514 00	749 50	60 00	5 00	712 50	413 75	167 94	581 69
North Aroostook,	97 15	118 60	215 75	27 00	4 75	215 30	167 75	48 00	215 75
North Franklin,	65 57	130 73	196 30	16 50	-	215 62	131 20	53 52	164 76
North Waldo,	93 98	220 20	314 18	24 00	-	326 75	240 50	18 75	-
North Penobscot,	118 90	103 00	221 90	21 00	11 00	384 32	175 28	61 25	236 53
Oxford,	154 62	655 30	809 92	30 00	10 00	389 50	272 85	434 50	790 33
Piscataquis Central,	150 32	489 34	639 66	40 50	3 00	316 34	276 23	248 56	521 79
Penobscot,	-	1,317 44	1,317 44	52 50	-	750 00	643 25	-	1,228 64
Sagadahoc,	281 16	1,098 07	1,379 23	73 00	2 00	805 75	610 15	456 67	1,366 82
Somerset Central,	160 00	300 00	460 00	40 00	-	565 00	500 00	75 00	-
Waldo,	290 47	1,260 00	1,626 47	73 00	18 00	900 00	237 50	254 00	1,727 00
West Oxford,	119 00	542 38	661 38	30 00	1 50	508 00	293 90	220 00	513 90
West Penobscot,	169 08	800 10	969 18	51 40	16 00	723 75	397 25	125 00	522 25
West Somerset,	113 81	234 00	347 81	30 00	8 00	398 00	365 00	64 75	429 75
West Washington,	239 47	545 17	784 64	50 00	-	877 85	527 95	236 65	773 60
York,	269 46	921 83	1,191 29	67 00	5 00	835 00	719 00	350 00	1,069 00

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Awarded for bulls and bull calves.	Working oxen four years old and over.	Steers under four years old.	Milch cows.	Heifers and heifer calves.	Fat cattle.	Trials of speed.	Stallions.	Breeding mares.	Amount awarded for other horses and colts.	Amount awarded for swine.	Amount awarded for sheep.	Amount awarded for poultry.	Total amount offered for live stock.	Total am't awarded for live stock.
Androscoggin,	15 00	44 00	41 00	38 00	15 00	6 00	17 00	10 00	-	23 00	-	13 00	3 50	231 00	225 00
Acton and Shapleigh,	5 00	31 00	24 25	11 25	6 75	8 00	6 00	4 00	3 00	22 00	4 00	10 00	5 00	124 25	151 25
East Oxford,	6 00	19 00	10 50	3 00	-	4 00	-	3 00	2 00	7 50	-	8 00	-	103 00	63 00
East Kennebec,	11 00	5 00	11 00	6 00	11 00	3 00	11 00	18 00	10 00	27 00	-	11 00	-	227 00	125 00
East Somerset,	9 00	21 75	16 75	7 50	6 25	-	105 00	5 00	4 50	15 00	-	-	-	360 25	190 75
Franklin,	18 50	41 00	40 25	6 50	4 25	10 50	66 00	20 50	5 00	10 00	-	9 75	-	302 40	232 25
Hancock,	3 00	17 00	15 00	39 00	5 00	-	172 00	15 00	16 00	20 00	-	23 00	-	392 00	332 00
Knox,	20 00	11 00	9 00	7 00	3 00	7 00	140 00	16 00	7 00	11 00	5 00	5 00	2 00	311 00	285 50
Kennebec,	12 00	48 00	20 00	14 00	11 00	5 00	24 00	7 00	6 00	18 00	7 00	8 00	-	358 00	180 00
North Kennebec,	25 00	49 00	25 00	29 00	14 00	15 00	22 00	18 00	10 00	24 00	6 00	25 00	9 00	431 00	337 00
North Aroostook,	4 75	2 00	1 75	10 00	4 00	-	50 00	15 00	15 00	6 50	2 00	2 00	-	67 00	63 00
North Franklin,	7 90	20 50	19 85	1 75	4 60	4 25	3 50	2 50	1 75	7 30	7 00	10 50	3 50	92 20	80 40
North Waldo,	11 50	41 00	11 00	18 00	3 50	-	68 00	12 00	5 00	20 50	-	26 00	-	248 00	216 50
North Penobscot,	1 50	5 50	13 00	5 00	6 50	-	20 00	-	3 00	16 50	2 50	7 00	-	154 50	65 50
Oxford,	10 00	25 00	10 00	5 00	5 00	8 00	48 00	6 00	4 00	16 00	3 00	7 00	-	198 50	185 00
Piscataquis Central,	7 00	59 00	14 00	3 00	2 00	-	80 00	9 00	6 00	19 50	2 00	13 00	-	244 60	217 00
Penobscot,	16 00	4 00	16 00	62 00	27 00	2 00	350 00	27 00	8 00	26 00	5 00	16 00	-	696 00	559 00
Sagadahoc,	18 00	32 00	19 25	20 00	21 00	8 00	38 00	16 00	2 00	31 75	13 50	22 00	6 00	290 00	246 50
Somerset Central,	32 00	39 00	22 75	25 00	13 00	-	60 00	18 00	9 00	19 25	10 00	21 00	5 00	-	-
Waldo,	-	20 00	11 00	-	6 00	-	63 00	10 00	5 00	26 00	3 00	19 00	2 00	191 50	-
West Oxford,	14 00	13 00	13 00	8 00	8 50	9 00	27 00	4 00	2 00	17 50	5 00	5 00	4 00	273 50	160 25
West Penobscot,	24 50	21 25	15 75	18 75	22 75	8 50	5 75	16 00	6 50	32 25	-	21 25	2 00	422 00	193 25
West Somerset,	29 00	46 00	45 00	21 00	17 50	-	-	-	-	-	1 00	34 00	-	312 00	296 00
West Washington,	31 00	9 00	26 00	18 00	23 50	10 00	183 00	-	14 00	30 50	3 00	15 00	1 25	525 00	354 25
York,	18 00	17 00	22 00	24 00	5 00	9 00	190 00	10 00	13 00	40 00	-	15 00	5 00	516 00	533 00

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Amount awarded for management and improvement of farms.	Amount awarded for manures and experiments with them.	Amount awarded for plowing at the exhibition.	Amount awarded for fruit and flowers.	Honey, sugar and syrup.	Butter and cheese.	Agricultural implements.	Household manufactures and needle work.	Manufactures of wood, iron and leather.	Other mechanical products.	For all objects not enumerated above.
Androscoggin,	-	-	-	26 75	1 50	18 00	6 00	19 25	9 50	-	60 00
Acton and Shapleigh,	-	-	9 00	13 50	3 50	13 25	-	49 00	3 00	-	84 00
East Oxford,	-	-	6 00	1 00	-	7 50	2 00	15 00	6 00	2 00	5 00
East Kennebec,	-	-	-	3 00	6 50	7 00	-	12 00	2 00	-	-
East Somerset,	-	-	-	-	-	10 25	-	7 40	-	-	-
Franklin,	-	-	-	-	1 00	4 00	1 00	20 50	2 00	3 50	4 00
Hancock,	-	-	-	20 00	5 00	18 00	2 00	17 00	6 00	8 00	37 00
Knox,	-	-	-	20 00	1 00	9 00	-	30 00	-	-	78 40
Kennebec,	-	-	-	8 00	3 00	24 00	15 00	65 00	15 00	13 00	15 00
North Kennebec,	-	-	-	7 00	3 00	20 00	-	20 50	-	-	-
North Aroostook,	-	-	-	-	75	8 00	-	10 00	-	-	15 00
North Franklin,	-	-	2 50	-	25	4 75	1 50	22 70	4 25	1 00	1 00
North Waldo,	-	-	-	3 50	-	5 00	1 50	13 75	1 00	-	-
West Penobscot,	-	-	-	20 85	4 75	17 25	5 25	48 10	1 50	2 00	-
Oxford,	-	-	7 00	13 50	-	4 25	5 00	14 46	13 00	-	13 64
Piscataquis,	-	-	-	2 25	1 50	17 00	-	25 23	-	-	1 75
Penobscot,	-	-	-	25 00	5 00	16 25	-	-	-	-	-
Sagadahoc,	3 00	3 00	9 00	24 75	4 00	18 00	1 00	63 15	5 00	11 00	165 50
Somerset Central,	-	-	-	-	1 75	12 00	-	40 00	-	-	-
Waldo,	-	-	-	10 50	3 00	11 00	-	24 00	2 00	-	-
West Oxford,	-	-	-	11 50	6 90	16 75	6 50	56 50	5 75	-	12 75
North Penobscot,	-	-	-	6 25	-	12 00	2 00	24 11	4 70	-	9 02
West Somerset,	-	-	-	-	-	10 00	-	18 00	-	-	-
West Washington,	-	-	-	9 50	1 00	14 50	1 25	30 25	18 00	-	-
York,	-	-	-	33 00	6 00	25 00	5 00	83 00	32 00	-	138 00

ABSTRACT OF RETURNS FROM AGRICULTURAL SOCIETIES FOR THE YEAR ENDING FIRST WEDNESDAY IN DECEMBER, 1868.

SOCIETIES.	Amount awarded for Indian corn.	Wheat.	Rye.	Barley.	Oats.	Buckwheat.	Hay.	Potatoes.	Carrots.	Beets.	Turnips.	Total am't offered for grain and root crops.	Total am't awarded for grain and root crops.
Androscoggin,	9 50	16 00	–	1 00	1 00	–	5 00	11 00	–	50	50	–	–
Acton and Shapleigh,	9 75	23 25	1 50	1 00	–	–	–	6 25	1 25	1 75	1 25	49 00	46 00
East Oxford,	9 20	3 00	–	–	3 00	–	–	3 00	–	–	–	47 00	18 20
East Kennebec,	6 00	–	–	–	–	–	–	6	–	–	–	92 00	12 00
East Somerset,	2 25	–	–	2 25	–	–	–	2 25	–	–	–	24 75	6 75
Franklin,	–	–	–	–	–	–	–	–	–	–	–	49 65	3 50
Hancock,	16 00	5 00	–	–	–	–	7 00	–	–	3 00	7 00	134 00	72 00
Knox,	10 00	43 00	–	3 00	–	–	–	9 00	–	–	4	228 50	77 00
Kennebec,	7 00	25 00	–	6 00	–	–	–	5 00	3 00	5 00	3 00	83 00	43 00
North Aroostook,	3 75	4 75	–	–	1 75	4 00	–	3 00	–	–	–	54 00	17 25
North Kennebec,	–	5 00	–	–	–	–	–	–	–	–	–	111 00	5 00
North Franklin,	2 00	8 75	–	1 00	1 00	1 00	–	4 25	–	–	–	47 95	18 50
North Waldo,	–	–	–	–	–	–	–	–	–	–	–	44 75	–
North Penobscot,	12 00	11 00	–	–	–	2 00	–	5 00	–	–	–	105 00	31 00
Oxford,	–	10 00	–	–	–	–	–	6 00	–	–	–	72 00	21 00
Piscataquis Central,	–	5 00	–	–	–	–	–	–	–	25	75	43 50	6 00
Penobscot,	7 50	–	–	–	–	–	–	7 50	–	–	3 00	122 50	18 00
Sagadahoc,	10 25	2 00	3 75	4 50	2 00	3 50	–	11 00	50	3 75	4 50	153 75	60 00
Somerset Central,	–	–	–	–	–	–	–	–	–	–	–	75 00	–
Waldo,	10 00	18 00	–	–	3 00	–	–	5 00	–	–	–	127 00	–
West Oxford,	10 00	1 50	–	–	–	–	–	150 00	50	50	50 00	73 25	25 00
West Penobscot,	26 70	16 00	–	2 00	2 50	2 50	–	30 45	–	–	–	184 20	91 30
West Somerset,	8 00	8 00	–	–	–	–	–	5 00	–	–	–	56 00	21 00
West Washington,	10 00	1 20	1 00	8 00	16 00	1 00	–	16 50	1 00	1 50	1 50	188 70	49 70
York,	18 00	5 00	–	–	–	–	–	2 25	1 50	1 50	50	115 00	–

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2.

ABSTRACT OF RETURNS

FROM THE

AGRICULTURAL SOCIETIES

OF

MAINE.

1868.

EDITED BY
STEPHEN L. GOODALE,
SECRETARY OF BOARD OF AGRICULTURE.

AUGUSTA:
SPRAGUE, OWEN & NASH, PRINTERS TO THE STATE.
1869.

MAINE STATE AGRICULTURAL SOCIETY.

Report of the Secretary.

The Maine State Agricultural Society was incorporated April 4th, 1855, and held its first exhibition at Gardiner, in September of the same year. The show was regarded as "very respectable" in all departments and the society was congratulated for having made so good a commencement. A considerable number of horses were exhibited, and in the department of neat stock grades predominated over full bloods.

The second Show and Fair was held at Portland in October, 1856. The gross receipts of this year amounted to $8,935.16, and $2,159.12 were awarded in premiums, of which $1,157 were awarded in premiums on the various classes of horses. Included in the above receipts is one thousand dollars granted by the State, annually, (provided the Society should raise an equal sum) for a term of five years. There was also paid into the treasury of the Society in 1856, five hundred dollars, granted by the State to be expended for the encouragement of flax culture in Maine.

Bangor was decided upon as the place for holding the third exhibition of the Society, where it took place in September, 1857. The weather was rather unfavorable, during the last day of the Fair, but notwithstanding this the entire exhibition was regarded as a success; the eastern portion of the State being well represented in the different departments of the same. The show of neat stock was not large, but there were more horses on the ground than at the first exhibition of the Society. The receipts of the exhibition were $7,408.10, and the expenses, (including about $3,800 in premiums and gratuities,) $8,000.

The fourth exhibition was held in Augusta, September, 1858. The show of neat stock "in numbers and excellence" was far superior to any former exhibition; the show of horses was not so great in numbers as at Bangor in 1857; while in sheep, swine and poultry, and in the display of fruits, dairy products, and manufactured articles the exhibition was superior in number and excellence. The gross receipts of this exhibition were $6,638.70, and the expenses of the year, including premiums and gratuities, $8,316.45.

The fifth Annual Exhibition was also held in Augusta during the month of September, 1859; and was reported by the Secretary of the Society as "a decided *success*, and a decided *failure*." There were about one thousand entries of neat stock, sheep, swine and poultry on exhibition, and a large display of grains, vegetables, fruits, flowers, implements and household manufactures; but three of the four days the exhibition was kept open, were rainy, and while in one respect the show was a success, financially it was a complete failure. The records of the Society do not show the amount of monies received and disbursed during the year.

The exhibition of 1860—the sixth from the organization of the Society—was held in Portland. The gross receipts were $6,919.68, and the expenses, including the sum of $2,337 as premiums, amounted to $8,514.48, making a deficit in the treasury of $1,594.80. With this show the exhibitions of the Society were suspended.

In 1861, the Society at their annual meeting, chose a committee to solicit from the Legislature a continuation of the annual stipend of one thousand dollars, which according to the terms of the act giving the same, expired in that year. The matter of holding an exhibition was left discretionary with the Trustees.

At the annual meeting in 1862, the President, Mr. John F. Anderson, alluded to the past efforts of the Society in advancing the cause of improved agriculture, and cited many individual cases which in the aggregate had been of great utility to the State. He also remarked: "The derangement in public affairs in consequence of the rebellion call for serious deliberation on the question of suspending for a time the operations of the Society until a more quiet condition of the public mind shall warrant more active operations of the Society in its legitimate work." In following out the plan above suggested the Society passed resolutions relinquishing its claims "upon the treasury of the State under existing laws, until the return of more peaceful and prosperous times;" asking only so much of the stipend allowed for the past year but not drawn, as should enable the Society "to meet its existing liabilities without bankruptcy," and recommending the continuance of the usual State aid "to the Board of Agriculture and the county agricultural societies."

In 1864 the following resolution was passed at the annual meeting: "Resolved: that the Maine State Agricultural Society look with great interest and solicitude to the disposal of the govern-

ment grant to Agricultural Colleges, and deem it advisable that said fund be expended for the establishment of a distinct farm and college, separate from any existing institution in the State." Similar resolutions were passed at the annual meeting in 1865.

The Society—and indeed the State at large—experienced a severe loss in the death of Dr. Ezekiel Holmes, which occurred Feb. 9th, 1865. The Secretary of the Society from its incorporation, the editor of the MAINE FARMER for more than thirty years, identified with every movement calculated to elevate and improve the industrial classes of our State, and a friend to every good work—his death made vacant a place that can never be so well filled by another. It occurred soon after the annual meeting in 1855 and immediately succeeding his labors before the Legislative Committee on Agriculture in behalf of the establishment of an independent institution under the act of the National Congress endowing an agricultural college in each state. At the annual meeting in 1866, the following resolution was unanimously passed:

"Whereas by a dispensation of Divine Providence Dr. EZEKIEL HOLMES was taken from us immediately after his last re-election to the post of Secretary to this Society; which office he had held from our first organization, and was therefore our main reliance at all times, and

Whereas, DR. HOLMES by his genial ways, his unflagging courage and irrepressible spirit, endeared himself to, and secured the profound respect of every individual member of our Society, wherefore

Resolved, that in the death of Dr. EZEKIEL HOLMES, late Secretary, this Society has met with an irreparable loss, and we, his late associates, mourn his death as that of an honored father."

At each annual meeting held since 1862, the matter of holding an exhibition had been left discretionary with the Trustees, as the same had been brought up at the various meetings. At the meeting of 1868, however, the general feeling among the members of the Society seemed to be in favor of holding a show; and votes were passed to that effect, also appointing a committee to appear before the Legislative Committee on agriculture, present the wants of the Society before them, and ask for an appropriation of one thousand dollars. The committee appointed attended to their duty, but as the Legislature did not see fit to make the appropriation, the Trustees at a special meeting held Feb. 10th, 1868, voted to hold an exhibition provided sufficient inducements were offered,

and Col. Geo. W. Ricker, a member of the Board, was appointed a committee of correspondence to solicit propositions from localities desiring the exhibition to be held in their vicinity. Col. Ricker issued a circular letter setting forth the wants and purposes of the Society, which was sent to different localities and to the most prominent agriculturists of the State. In this circular Col. Ricker said: "We cannot reasonably hope that the New England exhibition will be held in our State, while our own State Society is without its annual fairs. The locality selected for the State Fair this year will unquestionably secure the New England Exhibition next year. If you feel sufficient interest in the matter, and are desirous of securing the selection of your place for the proposed fair, please consult with your citizens generally, and the proprietors of your grounds, and inform me at your earliest convenience what can be expected from them, in the way of encouragement, of erecting sheds, and making the usual and necessary arrangements." In response to this circular but two answers were received; one from the city of Portland and one from the city of Augusta. At a meeting of the Trustees held April 1st, it was voted "To hold a fair during the fall of 1868, provided the city of ——— shall furnish grounds with track and sheds, halls and proper police force for their convenience and control during the days of the fair: all to be free and subject to the order of the Board of Trustees." In view of encouraging the Society to hold its annual fair in that place, the city of Portland voted to give $2,500 towards defraying the expenses of providing fixtures and accomodations for the same; and the citizens, through a committee consisting of Chas. P. Kimball, William Deering, J. B. Carroll, Chas. E. Jose and Jonas H. Perley—who were nominated at a public meeting, to act in conjunction with the committee of the City Government in the expenditure of the amount voted by that body—gave the following guaranty to the Trustees:

"The undersigned, in behalf of the citizens of Portland guarantee to the Trustees of the State Agricultural Society to furnish all the necessary accommodations for the State and county fairs to be held in this city the ensuing autumn—including grounds, track, sheds, stalls, pens and water—also hall privileges for the exhibition of mechanical and agricultural products, with an adequate police force, all to be free and subject to the order of the said Trustees."

The proposition from Augusta came from Mr. W. M. Thayer, one of the energetic citizens of that place, and although it was ample, and guaranteed everything asked by the Trustees, yet they were satisfied that gentleman had not sufficiently counted the cost of the fixtures that would be demanded by the Society, and they accordingly gave him an estimate of the same (which was very much higher than what he had figured) and also further time in which to raise an additional sum for the purpose. As further time was given to Augusta, the same was also extended to Portland, and the final decision as to the place of holding the exhibition was put off until May 5th. Meanwhile the Trustees vigorously commenced the revising of the premium list, perfecting the rules and regulations, and making up the different committees. It may be mentioned here, that from the first movement in the matter of holding the fair in Portland, the Trustees met with the most cordial and generous encouragement from the leading citizens of Portland, and the officers of the Cumberland County, and Portland Horticultural Societies. Without their hearty support and aid so wisely and unremittingly rendered, until the close of the Fair, the same success could not have been attained.

At the meeting of the Trustees held May 5th they unanimously voted to hold the exhibition of 1868 in Portland "provided the agreement signed by C. P. Kimball and others, under date of April 16th, 1868, be carried out as guaranteed by said parties in said agreement or guarantee." At the same meeting an arrangement was effected with the Cumberland County Agricultural, and the Portland Horticultural Societies, by which they were to unite their exhibitions with that of the State Society, release to the latter their annual stipend from the State, (amounting to about four hundred dollars) and upon a division of the net receipts they were to receive one fifth each, the State Society retaining three-fifths. A committee of the Board, consisting of the President and Mr. Wasson, were appointed to confer with the committees of the City Government and the citizens of Portland, and also with the local societies in order to perfect arrangements for the exhibition; and Sept. 29th and 30th and Oct. 1st and 2d was decided upon as the time for holding the same.

The revision of the premium list was a subject requiring a great deal of labor, and for that purpose several special meetings were held by the Trustees. They found the schedule of premiums offered by the Society in 1860 to be ill adapted to the present

requirements of the Society, in many particulars requiring radical amendments, and in others complete changes. It was perfected, however, and given to the public early in July, and the universal expression was that the list had been carefully considered, and made up with a judicious liberality that could but receive the hearty commendation of the people of the State.

Mr. Wm. S. Badger, the Treasurer of the Society having sent in his resignation, the Trustees, at the meeting held August 18th, elected Wm. E. Morris, Esq., of Portland, to fill the vacancy occasioned by the resignation of Mr. Badger.

At an early period in the perfecting of the preliminary arrangements for the Fair, Col. Geo. W. Ricker of the Board of Trustees was appointed Chief Marshal; Mr. Samuel T. Raymond, Superintendent of Grounds; S. B. Beckett, Esq., Superintendent of Halls; Henry Fowler, Assistant Superintendent of Grounds; John K. Hooper, Assistant Superintendent of Halls; J. F. Leavitt, Forage Master. Subsequently Mr. Percival was placed in charge of the Departments of Neat Stock, Sheep, Swine, and Poultry; Maj. Dill of Agricultural Implements, and Mr. Wasson of the Exhibition in the Halls.

The work of preparing the fixtures and accommodations was entirely in the hands of the Portland committee, and although the Trustees furnished the gentlemen acting for that committee with a schedule of their wants, and the whole was to be furnished to their acceptance, yet the details of the matter was completely in other hands. The schedule of the Trustees required two hundred and twenty cattle stalls, one hundred horse stalls, twenty sheep pens, ten swine pens, each pen and stall to be covered with a roof that should shed water, convenient accommodations for the display of agricultural implements, a good supply of water at the grounds, buildings for the uses of the officers of the Society, hall accommodations with tables, &c. It may be remarked here that the Trustees over-estimated the stalls for neat stock and under-estimated the stalls for horses—the display of the former at the exhibition being somewhat smaller than was anticipated, and of the latter very much larger.

The regulations of the Trustees required that notice of the intention to enter live stock should be sent to the Secretary at least one week before the day fixed for the opening of the show that proper accommodations might be made for their reception. In accordance with this regulation notice was sent to the leading papers in the State calling attention to the same, and in conse-

quence the larger part of the entries of neat stock were made sometime in advance of the day of opening. This regulation proved a good one, and it would do no harm to have it more strictly enforced at future exhibitions.

The ground selected for holding the out door exhibition was situated in Westbrook, just across the Portland line and about two miles distant from the City Hall, known as the "Forest City Driving Park;" and although the location of the grounds and track was not on many accounts so desirable as could have been wished, it afforded the best accommodations of the kind that could be obtained. Within the enclosure of the track and at the extreme right hand of the main entrance were located the horse stalls; while at the left of the track enclosure, was a separate enclosure devoted to the exhibition of neat stock, sheep, swine and poultry, the pens and stalls forming almost a complete circle around the outer extremity of the ground. In the centre of this area was a building 250 by 40 feet, in which the larger class of implements, such as mowers, horse-rakes, plows, threshers, &c., were exhibited. The offices occupied by the officers of the Society were located near the main entrance.

During the two weeks immediately preceding the time fixed for the opening of the fair, there was an unusual amount of cold, rainy, cloudy weather. It had rendered the ground completely saturated with water, the workmen engaged in erecting the stalls and pens had labored under many disadvantages, and much of the time they had been compelled to wholly suspend operations. Yet, notwithstanding these disadvantages, the Trustees had gone on perfecting their arrangements, and up to Friday, Sept. 25th, the rain at the time pouring down in torrents, as it had been for two days previous, no idea was entertained of a postponement. A very large number of the entries had been made, but two working days intervened previous to the opening of the show, a considerable number of horses had already arrived and more had started, work upon the fixtures at the ground had been suspended, and some one raised the question "Why not postpone the exhibition one week?" The Trustees—the entire Board with one exception being present—immediately held a meeting to consider the matter, at which the Portland committee, many prominent citizens, and some of the exhibitors who had already reached there, were present. The question of postponement was thoroughly canvassed from different standpoints, and especially in reference to its influence upon those

county societies whose exhibitions were already announced to take place the following week. While it was conceded that both would be injured to a greater or less extent, the former by losing the attendance of those who would be present at the county exhibitions, and the latter by those who would prefer to go to the State Fair; and while on either horn of the dilemma friction would occur, it was decided that to go on would result in failure, to postpone would be no less, and the exhibition, if postponed, might prove a success. Consequently it was voted to postpone the exhibition one week; the vote of the absent Trustee on the question of postponement being obtained by telegraph, that the opinion of the entire Board might be had.

The moment after it was decided to postpone, every available means was taken to notify the exhibitors, committees and the public generally of the fact. Wherever men interested could be reached by telegraph, that source of communication was made use of without regard to cost. The public journals were notified of the same through the agent of the Associated Press; every exhibitor and committee man was also notified either by telegraph or letter, and posters announcing the fact were distributed along the routes of the different railroads and sent to every place of importance; so that by Saturday night the action of the Trustees was generally known throughout the State. A few exhibitors were already upon the ground with their stock, and others were also on their way and could not be reached by telegraph in season to intercept their coming. Several exhibitors remained in Portland during the week of postponement, but their expenses were afterwards remitted by the Society. This, in addition to the other expenses, consequent upon the postponement, is estimated by the Trustees at something over one thousand dollars.

Advantage was taken of the postponement to make more complete the accommodations at the grounds and hall, to amend in some necessary particulars the regulations of the Society, to render more general throughout the State a knowledge of the benefits to result from the exhibition, and to personal effort on the part of the officers that nothing should be left undone that would in any degree contribute to the success of the Show and Fair. Not the least gratifying fact connected with the postponement, was that four county exhibitions previously advertised to be held the week to which the State Fair had been put off, generously postponed their exhibitions to the week following; thus showing how general was the interest in the fair of the State Society, and exhibiting a

feeling of friendliness and a desire to give precedence to our exhibition, as pleasing to the managers of the State, as it was magnanimous on the part of those of each of the County Societies.

There were three hundred and twenty-five entries of neat stock, sheep, swine and poultry; although the entries in the last three classes were very limited. It is worthy of mention, as an evidence of the improvement that has taken place in the character and value of the neat stock of Maine since the period when the exhibitions of the State Society were first held, that at this last show, nearly all the animals on exhibition, except working oxen, were full bloods, of the different breeds. No premiums were offered by the Society for grade bulls;—a measure not concurred in we presume by those who had good specimens of such animals, but one the wisdom and justice of which, with all who wish to place the improvement of our domestic animals upon a sure basis, will not be questioned. Among the most prominent exhibitors in this department of the show were Mr. John F. Anderson, (who shew thirty-three head of pure bred Devons,) Warren Percival and Levi A. Dow in Short Horns; W. A. P. Dillingham, Henry Taylor and John L. Curtis in Jerseys; and Nathan Foster, S. Dill, J. & L. P. Warren, and G. W. Hammond in Ayrshires. But few Herefords were on exhibition.

Of horses—not including those entered for independent trials of speed—there were one hundred and ninety-three entries. There were sixty entries of trotting horses. Altogether there were over three hundred horses entered for premiums—a far greater number than was ever present at any exhibition previously held in Maine, if not in New England. In this department the Knox stock largely predominated; Col. Thomas S. Lang, the owner of the celebrated "Gen. Knox" the progenitor of this breed in Maine (who was upon the grounds) being the largest exhibitor. There were also a few thoroughbreds on exhibition, prominent among them the stallion "Annfield" owned by Mr. Lang. In the numbers and value of the animals in this department, plainer than in any other feature of the Show, was noticeable that advancement in the principles of breeding, and that improvement in the general character and desirable qualities of the horse, that have taken place within the past dozen years, and won for our State so prominent a name in the raising of superior horses. In this department the exhibition was emphatically a *State Show*, the horses representing almost every county in Maine, and the number of individual exhibitors being far

larger than in any other class. Had this exhibition not taken place we could never have comprehended so perfectly the real progress made in the breeding of horses in this State. It is true every intelligent farmer was satisfied from the nature of things, and from the accounts given in newspapers from time to time of of the high prices paid for horses to go out of the State, that our horses were better, faster and worth more than in the earlier days of the Society; but at this exhibition it was proved to a demonstration; the evidences, ample and satisfactory, were before all eyes.

The number of horses entered for independent trials of speed was quite large, and the attendance to witness the different contests numerous; but no time worthy of special note was made. The track, having been plowed but a few weeks previous to the exhibition, was in poor condition, and good time could not be made upon it. It is only necessary, so far as the Trustees are concerned, to say that they were in no way responsible for the plowing of the track, having never ordered, suggested or advised it, and that whatever of blame has been cast upon the State Society for such action, rests entirely upon other parties.

Of agricultural implements there was a fine display, the one hundred and twenty-nine entries in this class representing but a small number, comparatively, of the articles on exhibition, as in many instances with mowers, plows, and especially smaller articles, six or seven articles were comprehended in a single entry. The principal contributors were L. Whitman, T. B. Hussey, Kendall & Whitney, Isaiah Frye & Son, N. M. Perkins & Co., J. H. Gilbreth, F. F. Holbrook, W. E. Barrett & Co. and F. E. Merrill.

Seven hundred and twenty-two entries representing nearly four thousand separate articles made up the exhibition in the various departments of the Fair, proper, which filled the spacious hall in the new City Buildings, together with the reception room and others connected with it to their utmost capacity. All who witnessed this part of the exhibition, unite in pronouncing it one of the most extensive and most attractive of the kind, ever held in Maine. The department of farm and garden products, was somewhat deficient in extent and variety; products of the dairy were also limited in numbers but of superior quality; the fruit and flower department was very attractive but would have been more so especially in the latter particular if the Fair had occurred earlier in the season; the gallery of paintings was universally

admired, forming as it did one of the most attractive features of the exhibition, and even as a collection of paintings by Maine artists representing a larger number of artists, and containing more of their works than was ever brought together on one occasion before; and the miscellaneous department, which embraced a great variety of articles of every description, presented a display of varied beauty and remarkable interest.

The exhibition opened on Tuesday, October 6th and continued four days; the weather with the exception of a slight shower Thursday afternoon being very favorable throughout. The attendance was very much larger than at any previous show as is fully proved by the report of the Treasurer. The total receipts were $12,656.05, nearly double that at any previous Fair. The premiums amounted to $2,918.50 to which are to be added twenty-two silver medals valued at $10 each, and 134 diplomas, costing $672, making a total of $3,810.50. The details of the exhibition having been given in all the leading papers of the State, and a copy of the reports of all the committees having been sent to every exhibitor; it is deemed unnecessary in this place to occupy space with a more particular account of the different departments of the exhibition.

A feature of great interest, one that has been too much overlooked at exhibitions heretofore held, and one that proved very successful at the late Fair was the evening meetings for the discussion of practical and important subjects, which were participated in by many of the best farmers of our own State and by prominent agriculturists from abroad. The opportunity presented by the assembling of so many gentlemen from different portions of the State, all interested in some of the various branches of agriculture, is one that should not be lost in an intellectual sense, but should be made the occasion of drawing out from them whatever they may have to give relating to the subject that is presented for discussion. In this way, and especially by the publication of these discussions, a double purpose is gained from our Fairs, their advantages are enlarged, and the good that follows from them is made to benefit a much wider circle than can avail themselves of the opportunity of being present at the exhibition. The success of this feature of the late Fair, is as gratifying to the Society, as it must have been satisfactory to all who in any way participated in it.

The interest in our exhibition, manifested by other States, and

by distinguished agriculturists, is also a matter of just pride. Among the prominent visitors were the Secretary of the Board of Agriculture of New Brunswick, the officers of the New Hampshire State Agricultural Society, the editors of the leading agricultural journals of New England, and others.

Looking back over the past year and contemplating the results of their labors, the Trustees of the Society, and those who were in any way connected with them in carrying out the details of the exhibition, may certainly find cause for personal satisfaction. Starting at the outset without funds, and with no guarantees of success but the confidence felt in the generally expressed interest of the people of the State to have the exhibitions of the Society revived, together with the generously proffered co-operation of the friends of agriculture and our industrial interests, the Trustees assumed the risk and responsibility of the exhibition. Fortunately, they each had previous acquaintance with their work, but some of the other officers of the Society were not familiar with their duties from actual experience, and labored under the disadvantages always felt by those who engage in any work for the first time. The difficulties to be overcome were greater than ever presented themselves to any previous Board of Trustees in making arrangements for a State Fair. They not only started without funds—as has just been mentioned—but the machinery of the Society had become rusty from long disuse; the veteran Secretary—upon whom for so many years the real work of the Society had devolved—was no longer present to give encouragement and advice, and the papers of the Society had been mostly consumed by the great conflagration in Augusta. There was little to guide and still less to encourage. But notwithstanding this they persevered, and the result, as is known, proved a most complete success, exceeding the highest anticipations of all. Let us not forget to mention, however, that this success resulted in a great measure, from the ready and generous manner in which the farmers, mechanics and citizens of the State generally, seconded the action of the Trustees, by lending to the exhibition the aid of their presence and their approval.

It is too late a day of the times in which we live, to speak of the advantages of such exhibitions. As a means of comparing the animals, natural products and works of different industries, in remote sections of the State, as well as of illustrating from actual specimens the results of persistent individual efforts on the part of

the farmer, fruit grower, breeder and mechanic, and of marking the material progress and prosperity of the commonwealth, such Fairs are of incalculable benefit; and it is only by maintaining them from year to year that our real advancement is made manifest. It is true a State Fair, in whatever section it is held, will to a great extent be largely a local representation; but this need not, and, with the abundant railroad and steamboat facilities for communication, by means of which distant parts of the State are brought near together, *should* not be. May we not expect—should the liberal inducements extended to the people of the State to become exhibitors that were offered by the different railroad and steamboat corporations, during the late exhibition, be held out in succeeding years, as we have no reason to doubt they will—that future exhibitions of the Society will be more completely State Fairs, containing in all departments representations from every portion of our State, and from every branch of industry in which our people are engaged.

The agricultural and industrial interests of the State are represented by the Industrial College, the Board of Agriculture and the State and County Agricultural Societies. These all work in harmony for the promotion of the best good of the farmers and mechanics of Maine, and each are deserving the aid of the State. The work of the State Agricultural Society lies in a somewhat different sphere from that of the Board of Agriculture, but its work is as necessary, and it by no means conflicts with the legitimate duties of that body. While it is the province of the latter to hold its annual sessions for the discussion of matters relating to the progress of agriculture in the several counties in the State, which are each represented at the Board, it belongs to the former to hold its annual exhibitions, and by drawing together the people, with specimens of their industry, from every part of the State, show to all, by actual examples, what that progress has been. The one stimulates the mental development of the farmer and artisan by gathering and diffusing information; the other seeks to show by comparison of objects, what that mental growth has accomplished, and how that information has been applied, in the improvement of stock, fruit, vegetables; in short everything the farmer produces or the mechanic manufactures. The one organization is as important as the other, and both are necessary for the complete development and representation of our agricultural and industrial resources.

The thanks of the Society are due to the following lines of

transportation, for the very generous terms upon which passengers and articles were carried and returned to the place of exhibition, viz.: Portland & Kennebec, Maine Central, P. S. & Portland, Androscoggin, Portland & Rochester and Grand Trunk Railroads; and to the Charles Houghton and Portland, Machias and Bangor Steamboat Companies.

It seems very desirable that the time for holding the future exhibitions of the Society should be so fixed and the arrangements so made with the county societies that there may be no interference in the time of holding the exhibitions. It would be a good plan, could it be accomplished, if the town exhibitions in a county could take place first, then the county exhibitions to receive the cream of the town shows, and lastly the State Fair, to receive the cream of the cream, or the best from each of the county exhibitions. It is certainly worthy of some effort in the way of correspondence with the officers of these societies, to bring about such a result.

The show of the State Society the past year marks a new period in the agricultural history of our commonwealth; and let us hope that from this time its annual exhibitions may go on uninterruptedly, and be a means of stimulating the energies of our farmers and mechanics in developing the natural resources and capabilities of our State, to a greater extent than has ever been known among us.

In behalf of the Trustees.

SAMUEL L. BOARDMAN,
Secretary Maine State Agricultural Society.

AGRICULTURAL DISCUSSIONS.

During the first three evenings of the exhibition, Farmers' Meetings for the discussion of practical and important topics were held in the rooms of the City Council, City Hall Building, which were very largely attended, the discussions being participated in by prominent agriculturists from all parts of the State. At the first meeting "Our Farm Crops: Their Insect Foes and how to destroy them," was the topic discussed, Mr. Geo. E. Brackett of Belfast making the opening remarks. At the second meeting, "Stock Breeding" was considered, the opening remarks being made by Mr. Lang. The third meeting was more largely attended than any of the previous ones, and at its opening Mr. S. L. Goodale introduced the following resolution:

Resolved, That the officers of this Society be instructed to prepare a memorial for transmission to the Privy Council of Great Britain through the British Consul or some other proper channel, representing the entire freedom of the State of Maine at the present time, as well as in the past, from any dangerous contagious disease in cattle, and requesting that the edict prohibiting the importation of American hay be so modified as to except such as may be exported from this State, such being the product of growth within the State.

The resolution was unanimously passed, and was subsequently transmitted to the Privy Council of Great Britain, through the British Minister. At this meeting the question "How can the farmers of Maine best improve their farms?" was discussed, Mr. S. F. Perley of Naples, making the opening remarks.

Having failed to obtain, from gentlemen who took part in the discussions, a full abstract of their remarks, although making an urgent request for the same, we are obliged to depend upon the brief, and rather unsatisfactory reports of the *Portland Daily Press* and *Maine Farmer*.

First Evening.

"Our Farm Crops; Their Insect Foes and How to Destroy Them."

Mr. George E. Brackett of Belfast, opened the discussion:

First—he called attention to "Wheat" and the "Wheat midge." The wheat crop in Maine has been small, but of late years it has improved owing largely to the absence of the midge. Some call it erroneously, however, "the weevil." The midge has existed in this country for years. Some courageous farmers have persisted in closely following up these pests and obtained fair crops.

This year the crop will be double that of last, partly on account of increased premiums by Agricultural Societies, and pastly owing to the absence of the midge. The midge has been both starved out and also killed by its enemies of the insect species—the latter a fly smaller than the midge itself.* Mr. Brackett gave an extended and very interesting description of the condition of the wheat crop, and the formation, growth and habits of the midge, offering many valuable suggestions as to the mode of destruction of the pest, the best of which he regarded handkilling. Barley and oats almost entirely escape the ravages of insects in Maine. It is only when insects are numerous that we notice them. They exist at all times, either in small numbers or in distinct localities. Squashes were next noticed. Mr. Brackett said he saw a mammoth squash on exhibition at the hall weighing some 250 pounds. He did not wish to see a larger one; in fact he preferred smaller squashes, such as the Hubbard. The little striped beetle, erroneously called spanish bug, was then alluded to, and the best way to kill it, is the sure way of doing so by hand. Often this insect destroys a whole field of squashes and pumpkins in a day. Every one has a theory of getting rid of these insects, but the only way he advocated was "separate death." He alluded to the box and fence methods, but many will escape in these ways.

Potatoes are Eastern Maine's principal crop. Among the best of new varieties are the Early Goodrich, Gleason, Early Rose and others. He referred to the great damage in the West from the potato bug of that section. The bug here was a very different insect. It is not often that an insect preys upon a crop in both larva and bug form. He gave interesting descriptions of the ten line pearmain bug and three line bug, the black beetle, and other insects peculiar to crops. Death by hand was also advised for this enemy of the staple article of domestic *cuisine.* Corn was next considered and the corn worm at length referred to. The only way to get rid of him is to dig him out and destroy him. Some apply manures and alkalies but they are not effectual. Plums were next mentioned. The curculio is their greatest enemy and should be checked in the larva state. Apples are the principal fruit here usually, but this year the crop is small, owing to various causes. The caterpillar, bark louse and borer were spoken of at length, and their habits of life and modes of attack described with clearness. In winter, as you see the old dead shell of the borer, look under it and you will find the eggs of the next spring's

insect. Then is the time to destroy them, for when warm weather begins they will come out in scores and by summer will be large enough to suck the sap of the fruit and tree, and in the fall their shells will form the covers for more eggs, and so on till the tree is destroyed. The common apple tree caterpillar was also alluded to. It has not ravaged our orchards as much this year as last. Its four stages of life were finely described, as follows:—Egg, caterpillar, cocoon, moth. The beautiful amber colored moth we see flying about our gardens and orchards is the destructive insect. The true method is to strike at the insect in its first stages of life, and not allow him to grow and do half the work of destruction before he is attacked. We cannot expect to rid ourselves of these pests without we devote time to the study of the subject and bègin at first principles.

Hon. Chas. S. Lugrin, Secretary of the Board of Agriculture of New Brunswick, was then introduced. He referred to those insects which troubled New Brunswick, and, among others, spoke of the common moth which destroys the fruit especially. He regarded the best way to save fruit is to gather early and ripen indoors. Currants near Frederickton, where he resided, have not done well, being attacked by insects. Hand picking seems the only safe way to follow. A few years since a worm attacked the fruit trees and left them as if blasted by fire. One year the spring opened warm early and then came severe cold, and that year fruit did better, and since then they have not been troubled. He also alluded to "the wheat midge," and spoke of the absence of them this year in New Brunswick. He advised a solution of potash being applied to apples to prevent the attack of insects. In conclusion he remarked that he came here to see and hear and was not prepared to make any extended remarks, and closed by thanking the officers of the society for their courtesy and attention.

Mr. S. F. Perley, of Naples, asked Mr. Brackett if the wheat midge feeds on any other grain, and if we cease to raise wheat we starve them out.

Mr. Brackett replied that so far as his knowledge went the midge did not feed on other grain, but might if forced to do so. He never read of any such occurrence.

Mr. Perley inquired "how we can best contend with 'the moth' or apple worm?"

Mr. Brackett thought Dr. Trimble's recommendation of hay

bands in autumn, placed around the tree and larger branches, a good remedy. They gather on the band and can be picked off.

An interesting discussion was here elicited as to the value of salt as an application, some favoring and some opposing it.

Mr. Nathan Foster, of Gardiner, suggested a quart of soft soap dissolved in two gallons of water, adding a handful of salt, as a good remedy.

Mr. Lang advocated raising cabbages only for one season on the same spot, and spoke of the striped bug as one of the greatest annoyances of the farmer in the raising of the plant.—He had successfully tried "the cotton pad" and recommended in gardens a thin layer of cotton slightly colored dark, spread over the cabbage and gathered closely at the stock and as a trap to catch the bug in.

Mr. Perley objected to offensive and other applications as a permanent remedy, as the rain could wash them off.

Mr. T. C. Hersey, of Portland, spoke of the successful use of kelp at Cape Elizabeth, where some of the finest cabbages in Maine were raised, and suggested the sea coast as being the best place to raise them.

Mr. J. F. Anderson also made some excellent suggestions, and asked Mr. Brackett as to what the canker worm is.

Mr. Brackett replied he had never seen one in Maine. It belongs to the moth species. The females are wingless and crawl up the tree and lay their eggs in the crevices. Destroy the females before they reach far up and you kill off the whole tribe.

Second Evening.

"Stock Breeding."

Hon. Thomas S. Lang, of North Vassalboro', opened the discussion. He said:

The farmer labors for subsistence that he may supply the necessaries and comforts of life, and add thereto those pleasures which are the reward of earnest toil and thoughtfulness. If you admit this, then comes the question, how shall we best acquire what we deem necessary or pleasurable? I have used the word thoughtfulness; it is applicable. By thoughtful, careful study of nature, and the laws which govern the production of all things, we shall be led to satisfactory results. Thus to breed stock with success, we are governed by general laws of reproduction. It is an aphorism that "like produces like," and this is in the mind of every farmer's boy a

tacit acknowledgment of the law of compensation or return, which governs every conceivable condition of life. As you breed, such will you produce. The question may arise, is this strictly true? I believe it, and if wrong, desire to be set right. Some of you who are stock breeders may say that this, the rule of "like producing like," is not absolute. I am aware it is not, in detail, and one often finds circumstances quite puzzling in his experience. The speaker illustrated this last point by an incident in breeding that came under his own personal observation, and then remarked that it had led him to adopt in his establishment, as a rule, efforts to control the influences upon the female while in heat and during the period of conception, and he hoped to be able to place before the public, at some time, the result of like experiments. Similar results, he contended, are often produced in a less marked manner. But what staggers one, said he, is to find two fine animals bred together, producing marked qualifications of preceding sires or dams, with scarcely a trait of their own sire or dam. These are facts which no breeder doubts who has given attention to his business. And those who are conversant with Mr. Goodale's excellent work upon the "Breeding of Domestic Animals"—a work which should be in the hands of every farmer and breeder—will remember the examples mentioned in his chapter upon the laws of similarity.

Mr. Goodale, with all accepted authorities upon this subject, urges that, to breed successfully, you must breed in the line. First, the breeder ought to know what he desires to accomplish before he takes the first step toward breeding. What are the natural advantages of the location in which you are placed, is the first question for you to decide. Is it better adapted for breeding cattle, sheep or horses? If you select cattle, which breed is best adapted to your farm or location? If for beef, that which furnishes the most pounds of beef in the shortest time is the one. If, however, you desire to make profit from the dairy, a different class must be selected. If your lands are high and rocky, they would be adapted for sheep, and the more hardy breeds of cattle. The short horn or Dutch cattle cannot be as profitably raised upon such lands. This matter of adaptation is an important one, and not studied with sufficient care by those farmers who breed stock beyond the necessities of home. Having selected the locality, now comes the selection of the animals of the breed desirable. If for beef, there can be no question that the breed that matures earliest is the best. Time is an important point. Suppose we fix that an

average amount of food given an animal up to three years of age yields 1500 pounds of beef, how much is gained over that animal which requires four or five years to arrive at the same weight? Here comes the advantage of breeding to a given qualification. It is a question of vital importance.

I have spoken of time as important to be considered, and this may lead you to remember the law of compensation referred to, which, if true, would lead one to suppose that the 1500 in three years would take a corresponding amount of food, as if fed to an animal in four or five years. This is not true. What I wish to convey is, simply, that the three years old has characteristics to assimilate more food to beef in less time. You find certain times or conditions in an animal's life that it seems almost impossible to lay on flesh, feed them ever so well. Then, why not find a class of animals that, with a given amount of food, lay on a double amount or nearly so from constitutional habit, health, vigor and power of assimilation? If you work your animals, you draw upon animal economy, and extra feed must pay for labor. A combination of milking, labor and beef qualities, seems to be the aim of the majority of farmers. "We cannot have the bread and eat it," is a proverb well understood. He who breeds to milk capabilities, must to a certain extent lay aside others as asserted. Again, it is well known that stock bred to milking properties admit of different classes—for instance, a Jersey cow gives you milk, the cream of which, in some instances, is fifty per cent. butter, while the cream from some cows will not make butter without much effort, and some not at all. I have several instances of this in my mind; yet these cows grew the finest calves. The Dutch stock, for instance, have been mostly bred for cheese making; they do not excel in butter making, but excel all others in growing their calves. The best milk for butter is poor milk to grow stock.

A point worthy of discussion in this connection, which my own small experience indorses, is, that what forcing a calf or other young animal has the first six months, especially the first three months, determines his subsequent value. I know that what is not done for a colt in the first eight months, cannot be remedied afterward. And on this point I will urge breeders to spare no pains or extra expense in feed or care of the dam four months before foaling, and for six months after, if she feeds the colt so long. While the bone is forming in the colt, give it all that will

be of benefit to it. In some the bone attachments become more positive and such animals are less likely to meet with trouble incident to weak, under-fed animals, ringbones, spavins, curbs, &c. I do not assume to urge this point upon you as notional ideas of my own, but as the experience of better observers than myself. While in Europe, in 1867, I visited several times, a large breeding establishment, where twelve different breeds of cattle were kept, and in conversation with the herdsmen this point was dwelt upon as very important, especially in the breeding of representative animals of stock, as a horse or a cow. The herdsman said, "Feed strong while a calf. If he will take the milk of two or three cows, give it. You will be paid. In other words," said he, "hoe and weed and water the plant while it is growing, if you care for its perfection." A few weeks since a letter from J. Keene Richards of Kentucky, who has expended so much in bringing to this country from England and Arabia the finest horses in the world, urges the necessity of feeding the mare and foal that the growth of the colt may be as great as possible while the bone is forming.

Having selected the class of animals one wishes to breed, the selection of the animal is of the first importance, for in the finest herds or flocks of carefully bred animals are to be found those which do not represent their class, and are incapable of transmitting the characteristics desired. The safe way is to select representative animals that do breed in line. A defective animal may breed fine progeny, but the progeny may breed the defective sire or dam's qualifications. Therefore the breeder should be sure of a sire as nearly perfect as possible in physical qualifications, and also one that has proved his get to be so. The more generations of fine animals in the line, the more certain of means in breeding them. However good a sire or dam may be, selected from mixed stock bred out of line, the chances will be often against you to breed like sire or dam. I speak more particularly of horses, but believe it is equally applicable to other stock. Were I to select horses to breed as close to perfection as possible, I would select only such sires as were bred in a long line of careful, judicious breeding, to the qualifications desired, either for speed, the sixteen hands carriage horse, or the horse for draft and work, endeavoring, at the same time, to select color, style, movements and temper, in each generation, as far as possible; then I should feel quite sure of success. I would go further, and never accept a dam who had

been previously bred to a defective horse, as his defects often crop out in the subsequent progeny, although by a good sire in the line desired. I have in my stable a chestnut gelding, sired by Gen. Knox, who is black and the gelding's dam is white, and the grandsires on both sides are white and black, yet the gelding is the color, marks, temper and gait of the sire of a colt dropped prior to her being bred to the black horse, and a very close resemblance to that colt by the first sire. I have seen repeated instances of like results in the course of my breeding. Another point desirable in the sire or dam, if we wish to reproduce him, is thorough health and nervous energy. Let his constitutional powers be as perfect as possible. I often hear surprise expressed at the uniform gait given to colts by the stallion Gen. Knox. I attribute the marked similarity to the splendid health and determined energy of his constitutional habit. Impair it, and those mares who possess great nervous energy will blot out his influence in their progeny. Ill temper is always to be avoided, as it unfits an animal for efforts of high speed or draft, and is always unsafe. How many breeders carefully consider the points necessary for success in their efforts, but accept such chances as may be thrown before them, at a small price, or such sires as are of easy access? In selecting a mare for breeding a fine horse, select such as will be sure to sustain the colt after its appearance, and as the sire as a rule gives general configuration and motion, let her add to and sustain them by her nutritive powers, giving constitution and energy. Let her temper be good, yet filled with nervous susceptibility, bearing in mind that the most nervous animal becomes the most tractable and easily trained or educated. If I could fix the matter, no mare who had a constitutional defect should ever be bred. A dam having spavins produced by light muscle attachments, or light muscles, or ringbone, or a cup produced by an ill-formed leg, is unfit to breed. Mechanical injuries, not produced by constitutional defects rarely do harm. No dam, imperfect in form or stature, of bad temper or bad feet, should ever be bred, and if a certain color is desirable, breed to that.

Before closing I wish to refer to the term thoroughbred as accepted to the public. I believe in thoroughbred animals and in their power to reproduce their kind, but I do not believe in assuming that animals are worth breeding because they are recorded in the herd or stud book for several successive generations. I have seen many worthless recorded thoroughbred animals, very far from

well bred; and also I have seen many thoroughly bred animals which could not be found in the stock or stud book. I approve of the record by all means, but the thorough breeding does not make the record. The time may come when men of wealth and leisure and culture will give their money and time and research to this interesting subject. I do not know of a more noble undertaking for such than to advance the interests of a State like ours in this respect, an interest to be felt in every household in Maine.

Mr. W. A. P. Dillingham, of Augusta, followed Mr. Lang. He thought that judicious legislation on this subject might be beneficial and useful. It can not be reasonably expected that farmers, who have to work hard for a living, should find time to comprehend all the phases of stock breeding. Before men can give proper and full attention to this subject they should have that leisure to study this question which wealth gives. He thought the prospect of great improvement in stock breeding grew brighter and brighter every year. Our young men have now much greater privileges than their fathers had to learn the best mode of raising cattle and horses. Our Agricultural College, he thought, was destined to do a vast amount of good.

Mr. J. F. Anderson of Portland, thought that a mere horse exhibition would not excite so much interest and draw so many people together, as a mixed show, including cattle, horses, sheep, mechanical works and everything that belongs to the farm and the shop. He liked the present exhibition, and hoped such exhibitions would be continued.

Mr. Lang fully endorsed the remarks of Mr. Anderson, and thought the horsemen and cattlemen ought to draw together. By adopting this plan money would be put in the treasury of the Society, and all interests would be greatly advanced. He believed the breeders of horses had rights as well as cattle breeders.

Mr. Henry Taylor, of Waterville, wished to hear something in relation to growing calves, for he felt an interest in the subject.

Mr. J. M. Carpenter, of Pittston, said that farmers must see to it that they have the right breed of cattle, such as are properly adapted to their farms. He did not care about going into extremes in regard to cattle or horses, and yet he thought the Gen. Knox colts were good for work as well as trotting, and it is very agreeable to have a colt that can go in 2:30 once in a while. With regard to breeding calves he thought much depended on weaning them in a proper manner, and giving them enough to eat during

that time. The best way to wean calves is to do it in such a manner as not to let them know it.

Mr. Lang hoped the discussion would be limited to breeding and not to feeding, for he thought breeding was of more importance than feeding, although feeding must not be neglected.

Here some desultory remarks were made by several gentlemen, but finally they all agreed on calling upon Mr. Lang to address them on the subject of breeding. He again addressed them, and then called upon Dr. Tewksbury, who said he was much interested in the remarks of Mr. Lang. He said that all animal life came from an egg, and argued the point from a physiological standpoint. He alluded to the doctrine recently discussed of making a sex to order, and desired more information on the subject.

He called on Mr. Lang, who said that he had conversed with Agassiz upon this point. But we cannot give what was said upon this subject, for the remarks were not intended for publication.

Mr. Lang said Maine has the soil and climate for raising good horses. But we must go into thorough breeding or we shall go under. Time has been when Maine horses would command a higher price than horses from any part of the world, but that time has gone by. He spoke of France, and thought she was going ahead of England in producing good horses, and if we should adopt the course the French people are now pursuing we can raise as perfect horses as they can. But we cannot do it unless we bestir ourselves in this matter.

Third Evening.

"How can the Farmers of Maine best improve their Farms?"

Mr. Samuel F. Perley, of Naples, was introduced as the gentleman selected to open the evening's discussion. In introducing his remarks he alluded to the great breadth of the subject announced, and consequently embracing every feature of farming life. The soil of Maine is varied, consisting of sand as well as loam. The ability of the farmers of Maine was asserted as varied, each section of the State having many leading minds as also many who still need light. No definite answer can be made to the question, "What is the best mode of farming?"

The pioneer farmer was described, and his work and needs alluded to with much force. A large amount of muscle, resolution and capital is needed to clear the way for a good farm. The son should improve upon his father; there should be careful study and

discrimination in plowing, sowing and husbandry. Different soil requires different treatment. Mr. Perley advocated each farmer having a speciality, and spoke favorably of raising hay. The seeking of markets and sale of products was then considered with much force and clearness. Animals should be loved, and interest taken in farm work as a labor of love as well as investment. He was opposed to mixing crops on one ground, such as squashes, corn and potatoes—keep each crop and kind separate. Brains are needed more than muscle, and it would be profitable for farmers not to work so hard themselves, but hire more labor and study more the science of farming. Stock raising flourishes best back inland, and hay near the sea.

Mr. Perley gave some figures in support of his ideas of hay farming, as opposed to stock farming exclusively. Manures had better be bought and hay sold at present prices. Near the cities and large towns it may be otherwise. Manures are better than fertilizers, although the latter should be used in part. Economize everything in farming, and use all your thought and skill in managing your farm as a merchant or a business man does in trade.

J. M. Carpenter, Esq., of Pittston, made some remarks and gave some interesting figures in support of stock raising and keeping the hay at home for the benefit of the stock. Good stock and its products are worth more in the end than to sell the hay.

Mr. Perley said he only alluded to the profit arising from manures from hay, and not as to stock breeding in itself. It is the wintering of stock that makes it unprofitable to raise hay altogether.

Rev. Mr. Dyke, of Bath, made some felicitous remarks as to the necessity of greater study and thought—brain-work—among farmers, and was glad to know of the success of the Agricultural College.

Hon. Chas. J. Gilman, of Brunswick, inquired the value in returns between fertilizers and compost.

Mr. Perley replied that manure in itself was superior to fertilizers.

O. Whittier, Esq., of Vienna, favored fertilizing—and manure was better than anything else—increase the stock and improve it by keeping the hay.

Rev. W. A. P. Dillingham, of Augusta, made some extended and interesting remarks as to the profit of making the farm productive by clearing land and using the means found on the farm to

turn to its benefit. Double up in managing farms till they become of great richness and productiveness. Cultivate the soil by studying new and better methods. He gave a description of his success in this way on his own farm. He advocated keeping hay to improve the stock with, and using compost before other fertilizers. He alluded to fruit culture as one of the best sources of profits. Care for young trees as for children; bring them to growth carefully. Hand-pick your fruit and cull it with particular pains; bruises bring decay.

Col. Thomas S. Lang, of Vassalboro', made some interesting statements as to his experience in stock breeding, manures and crops, showing that fertilizers were good, but compost manure better, and by breeding good stock the value is increased. He gave figures to support his position.

Geo. F. Talbot, Esq., of Portland, made some interesting remarks favoring a speciality in farming, and in favor of selling hay for cash and buying fertilizers.

Leander Wetherell, Esq., of Boston, editor of the *Cultivator*, was called upon, and made some lengthy but very able and valuable remarks upon farming interests, referring to facts in connection with Connecticut River Valley and Eastern Massachusett's farming. He alluded to the recent raising of tobacco on the Connecticut river and Massachusetts, and showed that the profit from tobacco far exceeded the cost of fertilizing the soil, and the soil being enriched it was all the better for farm crops. Better keep hay at home and feed the cattle than send it to England. He endorsed the remarks of Col. Lang and others as to manures and stock breeding, and quoted Liebig in support of rotation of crops, opposing the idea of speciality in farming. Keep good stock. He alluded to scientific sheep breeding of George Hammond of Vermont, and advocated its adoption—breeding in of fine marked stock—watching every sign of value carefully. Don't be discouraged if you all do not get prizes—work for each other in common good.

The discussion was continued late, and was participated in by others, including several prominent agriculturists, among them Gen. Natt Head, President of the New Hampshire Agricultural Society, Moses Fogg, Esq., of Gorham, and others.

President Scamman made some pertinent remarks, referring to the success of the Fair, thanking gentlemen from other States

for their presence, and urged all forward in the noble work. The meeting then adjourned.

Agricultural Implements.

Extracts from the Report of the Committee on Agricultural Implements; S. F. Perley of Naples, Chairman.

"There was a large and varied exhibition of agricultural implements, generally of good workmanship and of the latest and most approved patterns. The manufacturers and venders of these implements, in our own and other States, are certainly entitled to high commendation for their efforts to supply the farmers with good tools, and for doing well their part in contributing to the interest and usefulness of this exhibition.

Your committee, happening to be composed of plain, practical farmers, with an eye more to utility than fancy, beg leave to suggest that in some instances time and money have been wasted in a needlessly high finish and in ornamental painting. They would discourage all such expense, and suggest that a simple coat of varnish or paint to protect the materials of which the implements are composed, is all that is needed or desired by the farmers.

We notice with pleasure and highly commend the practice of the best manufacturers of chill-hardening the parts most exposed to wear of plows, cultivators, horse-hoes, &c. The durability and efficiency of tools thus finished is greatly increased, and farmers will not be slow in discerning this excellence, and in becoming patrons of manufacturers who send out such work. And here justice compels us to call attention to the fact that the castings of implements presented by exhibitors from other States, are generally smoother, (not by grinding) better fitted and the parts subject to greater wear, better protected by chilling than those manufactured in Maine. We call attention to this fact, in order that our Maine manufacturers who now, as we believe, excel in their patterns, particularly of plows, as adapted to Maine soils, may be led to excel also in quality and durability of their work.

By the rules of the Society we are directed to award medals or diplomas to the best articles in their several classes. In the absence of all instruction as to what shall constitute the best, the committee have to say, we believe true excellence consists in the adaptability of any implement to perform well the work for which it was intended. Good construction is, of course, necessary, without it no implement is perfect, but good work is the all important point of excellence. We have further to say that we

cannot, neither do we believe any one can judge correctly of the work an implement will perform, particularly the plow, without putting it to actual trial. Time and means not being at command to do this, we content ourselves, and hope the exhibitors and Society will approve our course as based upon common sense, by reciting the excellencies or defects of the articles, commending where it seems worthy, and suggesting improvements in some cases, but withholding premiums except where we find undoubted merit.

* * * * * * * *

The harrow was formerly an implement having a wood or iron frame, set with pointed teeth as used for tearing in pieces turfs, pulverizing clods, and in levelling and smoothing the surface of plowed land. Its action upon new rough land was and is satisfactory; but upon old fields it was observed that, from the pointed form of the teeth, while it pulverized the surface, it compacted the strata beneath; this has led to a change in the form of the teeth verging towards the cultivator; and this change has so changed the character of the implement, that at the present day it is difficult to determine which is the harrow and which is the cultivator. This point we leave for the exhibitors to settle, and take the implement by the name under which it is entered. And, while we accord to the spike-toothed harrow its full merit in its appropriate place, we at the same time express our decided preference, all things considered, for the cultivating harrow, or the implement which, while pulverizing and levelling, also loosens instead of compacting the soil.

Honorable Mention.

The following comprises a list of articles which received from the Committees in the different departments of the exhibition, honorable mention as articles of superior excellence:

Fruit and Flowers. Apples—J. B. Coyle, Westbrook; J. B. Brown, Portland; D. P. Livermore, Hallowell; John Currier, Waldoboro'; Joseph Taylor, Belgrade. Pears—F. L. Hutchins, S. F. Perley, Naples; J. B. Brown, Portland; C. Spaulding, Hallowell; E. B. Whitney, Joseph Taylor, Belgrade; S. L. Goodale, Saco. Grapes—J. W. Manning, Reading, Mass.; Dr. C. W. Robinson, Westbrook; Lorin Adams, Wilton; Geo. R. Davis, Portland; S. L. Goodale, Saco. Flowers—George Grant, Franklin, Mass.; D. Hill, Peabody, Mass.

Agricultural Implements. Plows—F. C. Merrill, South Paris; F. F. Holbrook & Small, Boston, Mass.; W. E. Barrett, Providence, R. I.; F. F. Littlefield, Portland. Horse Hoes—Dunham & Currier, Bangor; F. F. Holbrook & Small, Boston, Mass.; W. E. Barrett & Co., Providence, R. I. Horse Hoes and Cultivators combined—D. R. Allen, Cumberland; T. C. Merrill, South Paris. Plow Follower—P. Wilson, Newport.

Manufactured by Machinery. Carpets, Rugs and Window Shades—Marrett, Poor & Co., Portland. All-wool Flannel—North Berwick Woolen Co. Cloaking, Fancy Cassimere and Repellants—Locke & Merserve, Portland; also for same, Farnsworth & Co., Lisbon; also for same, Pennesseewassee Mills, Norway; (Deering, Milliken & Co., Portland). Mens' Knit Under Garments—J. L. & J. A. Lang, No. Vassalboro'.

Bread, Syrup, Sugar and Honey. Pilot, Navy, Soda and Graham bread—Reuben Kent, Portland. Fancy Confectionery—L. J. Perkins, Portland. Honey in Boxes—H. N. Parks, Gardiner. Sugars—Forest City Sugar Refinery, Portland.

Miscellaneous. Burial Caskets—S. S. Rich & Son, Portland. Doors—Cummings, Leavitt & Wilder, Portland.

TREASURER'S REPORT.

To the Trustees of Maine State Agricultural Society:

GENTLEMEN:—I have the honor to present herewith my account as Treasurer, for the latter part of the financial year, ending January 27th, 1869.

RECEIPTS.

Receipts from the Seventh Annual Exhibition, holden at Portland, on the 6th, 7th, 8th and 9th days of October, 1868, from the sale of tickets, rental of grounds and entrance fees, &c.,	$12,656 95
Received of Wm. S. Badger, Esq., former Treasurer,	9 10
	$12,666 05

EXPENDITURES.

Expenditures—Premiums awarded,	$3,328 50
Expenses of the exhibition,	7,237 95
Balance in hands of Treasurer,	2,099 60
	$12,666 05

Respectfully submitted,

WM. E. MORRIS, *Treasurer.*

ADDRESS,

Delivered before the Maine State Agricultural Society, at Lancaster Hall, Portland, October 9th, 1868.

BY HIS EXCELLENCY J. L. CHAMBERLAIN.

Being introduced by Hon. SETH SCAMMAN, President of the Society, His Excellency GOV. CHAMBERLAIN spoke as follows:

Cicero tells us of a certain Greek orator who was invited to speak before Hannibal, and thought it befitting the occasion to deliver a lengthy discourse upon military art and the office of a general. At the conclusion the great soldier was asked what he thought of the orator. He replied with more force than elegance, that he had heard many silly old men in his day, but this orator was ahead of them all. What flippancy and presumption before Hannibal, who for so many years had contended for the empire with the Romans—the conquerors of the world—for this Greek man who had never seen the enemy, never seen the field, never exercised the smallest particle of any public office, to undertake to give precepts on military art!

So it may seem to you, veterans of a hundred fields, presumptuous in me to discourse in your presence of the farmer's calling or the Art of Agriculture; for if I assume to instruct, or criticise, you will deny my competency as an expert; and if I seek to encourage you, and praise your vocation, you will want to ask, why, if I think farming such a super-eminent delight, I don't try my hand at it myself. I have serious thoughts of it, my friends, but the fact is you don't seem to favor it yourselves. A very respectable portion of you, it is true, seem kindly enough disposed towards my devoting the rest of my days to farming; but the majority are still so stubborn, or so jealous lest I should beat them at it, that they won't give me the chance.

But yet do not shut me wholly out from your fellowship; for during just one-half the years it has taken to bring me to the age of wisdom, I suppose there was hardly any duty or function of a farmer's boy that I did not have a hand in.

And I mind me of a certain twenty-acre lot, where my father gave scope to my boyish ambition and I went at it single-handed, from what time the axe was laid at the root of those mighty trees,

until it smiled in graceful harvest. Yes, I have cleared a field! and there is still something within me that wants to do it again.

Since that, my main work in life has been different, and such harvests as have been vouchsafed to me, have been reaped from other fields. But it is the truth to say that in no other work or achievement, have I felt a purer or a prouder joy than when, in the calm summer twilight I never forget, I smoothed the brooding earth over that last breadth of grain, and knew how Paul felt when he saw in this the emblem of the great resurrection.

Do you wonder that the last time I went home I walked out there with my little daughter, and sat down and sighed for something I had not?—something that you, kind friends, with all your honors could not give me—the sweet rest, the calm mind, the sound body, the heaven-lifted soul of those dear days of old? These are pleasing memories; nor are there brighter dreams of the future—if it is permitted still to dream—than the peace, the freedom, the breadth of view, all the lulling sounds of field and forest, the breath of the home-returning kine, the smell of the upturned earth, the sight of waving harvests in green and gold. Can you deem me over-weak if I long for these again to dispel the lingering visions of the earth upturned by fiercer implements, and the thick-strewn harvests where pitiless Death mowed down your strong and brave?

Thus it is, that when I yielded to the wishes of your Executive Committee, the diffidence I felt at speaking on these things before you was overcome by the pride I felt in your honorable record, and my interest in your calling.

Distinguished as the State is for some specialties in business, it cannot be denied that by far the greatest part of our productive industry is within the vocation of agriculture; and it is a fact of which you may well be proud that our public character as a State in social, moral and political, and even military affairs, takes its type and tone from our agricultural population. It becomes therefore a high official duty as well as a personal pleasure, to appreciate the services, encourage the labors, and promote the prosperity of those who contribute so largely to the public sustenance and to the public character. It would also be ungenerous and untrue to say there is a lack of interest here in agriculture; for all this bountiful and magnificent array before us, these fruits and fabrics, these finished implements and curious inventions, these animals so perfect

of their kind—nay, this noble and beautiful assembly of men and women—for these be it not forgotten are representatives of the farm; all this I say, will put any doubter to the blush. This interest is also attested by the fact itself that you are holding this fair—upon the unparalleled success of which I must congratulate your Society—to be followed by others in every county; by all the Boards, Associations, reports, published communications, as well as legislative acts, which show that men feel that there is something in the matter worth attending to.

For all this, I think it is fair to say that the farmer in this State is not over enthusiastic. All the public performances are jubilant, but the individual farmer is apt to be grumbling. Our season is short; the soil not so rich as elsewhere; the rocks plague him; the midge is after his wheat; the rust his potatoes; the coons his corn; the dogs his sheep; the boys his fruit;—that is, if the drought hasn't got everything beforehand. He groans, being burdened. Under such a rallying cry it is no wonder that he doesn't go at his work with much heart. His boys are not likely, either, to be captivated by that strain. They hear of broad prairies needing neither axe, nor grubber, stone drag nor manure cart, to force a living from the soil, of magical cities where a fortune is made in a night, or of distant territories where everything even to the mountains is on "a gold basis," and they strike out for themselves. Those who succeed come back with smooth hands and fine airs, and with money enough perhaps to buy out their father and all his neighbors. This of course works powerfully on the imagination, and the neighboring young people anxious and ambitious, bid the old homestead adieu, which unfortunately doesn't mean *a Dieu*—commending them to God—but quite the reverse.

And he who is best disposed, most earnest and patient, finds that he can't succeed without hard work, and that at the best, farming requires a vast deal of prudence and care, and even then its returns are somewhat precarious and comparatively small. He is more dependent on chances of the weather than the sailor, and can't get his crop insured for the season, as the other can his ship for the voyage. The worst is that his boys, too, energetic and capable as they are, will be likely to take one of those farewells which don't leave much *welfare* behind them.

This has affected me much, and I have more than once taken what seemed to me a proper occasion to express my views on it

with such brevity as I could, which has still appeared to some a culpable prolixity. I can hardly now do more or less than to insist upon those views with that familiarity of expression which this occasion happily permits.

Without wishing to appear boastful of Maine, I am not willing to have her misunderstood and decried. We can bear to see how matters stand. It appears that the yearly value of our hay, potatoes and grain alone at the last returns was not much short of thirty millions, and if we take into account the other products of our farms, such as the smaller vegetables and fruits, stock raising, and domestic manufactures, it will swell the amount to nearly fifty millions annually—a business within the legitimate sphere of agriculture, which ought to be considered respectable in quantity if not in quality, and equalled by no other State in New England except Massachusetts.

I have been curious to learn why, with so large an amount of business, this depreciatory feeling prevails; and have taken some pains to see if it was poor returns that caused it. Statistics show that when we do try we succeed well enough. It will be gratifying, perhaps surprising, to you to know, that in the yield of the principal crops we range much beyond the average of the whole United States; for example in 1866, we exceeded the average of the States in corn by eight bushels to the acre, wheat two and three-fourths, rye four, barley two, buckwheat ten, potatoes fifty-six—and in most other things in similar proportion. These statistics show some curious things. Wheat, that we think we can't raise, gave us in 1866 five bushels more to the acre than the average of Illinois, Indiana, and Ohio, and upwards of three bushels more to the acre than the average of Pennsylvania, Delaware and Maryland; while hay, that we think we *can* raise, yielded half a ton the acre less than in the other States I have named. Moreover, it is our principal article of produce—the crop of 1866 being of the market value of $18,500,000—yet the yield was less to the acre than that of any State in the whole country, viz., eight-tenths of a ton.

For one it appears to me that these few careful statistics should stimulate to a very different state of feeling and practice from that which prevails. 1866 may have been a remarkable year, but that such a result is possible at any time, ought at least to silence the grumbler and shame the sluggard.

Now there are some inferences from these figures. 1st, we see that our principal crops are made so by large breadths, not by large yields—the tendency is to extend the area rather than increase the fertility. 2d, the land is not at fault. Properly treated it yields as good returns for labor as any State in the country. 3d, we are not yet perfect in our theory or practice of cultivation.

These inferences may be taken as a rough statement of the case pro and con; and they afford the basis for the frank and friendly suggestions which I venture to offer here. You will take them for no more than they are worth.

The practical question now is, to what shall we look for means and aid to improvement in agriculture. Let us at the outset dismiss the thought that Legislation holds the keys of our destiny. The State has been liberal towards agricultural interests, and is willing to do more still. But as for any direct subsidy, or laws favorably discriminating, it does not seem to me that it would be of any good effect. The best that legislation can do agriculture is to give it a fair field and a free run. Trade is its own regulator. Supply and demand make their own laws and we cannot mend them much. The best effect of bounties and prizes I take it, is to stimulate to experiment, and diffuse knowledge by comparison and competition. But the very same result is effected by a steady market and brisk demand. You did not hear people asking for special privileges when the war came down on us with its hungry mouths. They didn't discuss the tariff. Free trade and protection whistled Yankee Doodle at each other as they whirled their wool and leather, and hay and cattle to the front. There was no lack of materials, and there was no lack of means, the moment there was a strong demand. If legislation can in any way reach the demand, there is the field for it. If it can by a wise policy encourage related industries; give impetus to latent energies; stimulate all handicrafts and arts of life, call in and sustain an active and healthy population; it will do more for agriculture than by any direct aid whatever.

What we want then is a home market—close home. That more than anything else will render the pursuit of agriculture profitable and popular. Then will follow—reacting and interacting—improvements in culture; higher intelligence; better manners; better arts; and when the true ends are realized, a happier condition for society and for the good and glory of the State.

Now there are are some little matters of political economy that we do not always think of as we should. We talk about richness of soil, and proclaim Thanksgivings for abundant harvests. But it requires something more than both of these to make prosperity. Were it not so you would not have seen the cotton States on the verge of ruin from the super-abundant crop of 1861, nor the luxuriant West looking with sorrow at her teeming fields and reduced to the dire extremity of burning her corn for fuel, because if sent to its distant and surfeited market the toll would take it all. Abundant crops tend to lower prices, and in a region purely agricultural the market is always distant and sometimes overstocked, either of which diminishes the profits, and both will sometimes produce financial distress in the midst of agricultural plenty. No such thing could happen where there are varieties of industry. Good seasons will not glut the markets, nor will bad ones cause distress —for prices will rise by a limited supply, and so the farmer will be partly compensated for waste of labor on spoiled fields. If half a crop pays as much as a full one, there is no great loss. Now take Massachusetts; why with her poorer soil and her half million less acres in cultivation than ours, does she so surpass us by millions of dollars in the value of her agricultural products? Because three quarters of her working population are engaged in manufacture of some kind, leaving the farmers who make up the other quarter to feed all the rest, if they will. The great diversity of industries in that State requires a larger consumption than the local production. The home market is greater than the home supply. This makes the home producer master of the situation. It stimulates the farmer to devote himself to those specialties which are the most profitable. He is near and can take his choice of the market. He finds what he can raise best and then makes the most of his ground.

It is this variety of industries which gives the farmer just what he requires—a near, sure and diversified market. The certainty, quickness and variety of his sales more than make up for deficiencies of soil and season. Here if we are wise enough to see it, is one of the great compensations which nature everywhere affords. She is lavish in her variety, infinite in her combinations. But the key is not deeply hidden. Ordinary sagacity and moderate skill will be able to seize upon the advantage, and turn to account all the peculiar circumstances of the situation. This should rebuke those who give themselves over to idle despair because they are

not somewhere else than where they are; for the law is the same everywhere for all the best blessings that we must seek in order to find, and knock for it to be opened.

We see the advantage, too, of keeping our raw material as near home as possible, to be wrought into fabrics here; to give employment to all industries, to encourage native talent and skill, and to attract a population of diversified employment which is the very best encouragement of Agriculture. It is better to bring the market to your goods than carry your goods to the market.

One evidence that you already appreciate the fellowship of the various industries, and their reciprocal benefits, is seen in this exhibition before us. You have gathered here not merely the products of the soil, but the products of skill; not merely the beauties of nature, but the beauties of art. In this you testify your cherishing regard, and they in so coming acknowledge their common allegiance.

It should give you great encouragement also that the State is now waking up to a sense of her "manifest destiny" as a seat of industrial arts. Her remarkable facilities for manufacturing are now becoming more than a matter of mention. Enough has been done to show what can be. The recent Report upon the water powers of Maine, in which our resources are merely hinted at, is already doing a good work. Capitalists and practical manufacturers are calling for it with eagerness, and agents of proposed colonies of skilled workmen from abroad are turning their steps hitherward. Every new establishment of this kind—every step of advance in their interests, will be felt directly by the farmer. Foreign capital will come into the State and be expended chiefly in what you supply. This will enhance the value of your lands and waters; your timber, and stone and bricks; your stock, and farm produce of every kind. The Railroads, too, will open living streams where there is now stagnation.

The best medicine for Agriculture is the grand progress of related industries:—what the physicians would call "constitutional treatment;" bracing up the general system, giving vigor to every part and freedom to every function; the health of each dependent on the health of all. It comes to this, then, that the farmer who will benefit himself, must take an interest in others. His prosperity lies in a broad and generous recognition of the whole industrial system of society. This is one of the few exam-

ples of that paradoxical maxim, "The longest way round is the shortest way home."

Along with all this, if not before it, must go Intelligence. I should scarcely be pardoned for intimating in such a presence that we need to grow in knowledge. But I venture to say it. Whether it comes from books, from tradition, or from experience, isn't of so much account. If a man only knows, for example, that to raise grain successfully, he must also raise clover and peas and crops of that kind and keep them on his farm and give them back with their rich freight of nitrogen to feed his grain field, it is no matter whether he learned it from his grandfather or the school mistress, or hit upon it himself. But that is one of the things he ought to know—the very philosopher's stone of agriculture—the alchemy which turns all base things to gold. So if he understands that by a judicious tillage and skillful application of dressings, he may loosen from the very granite rich elements of food, and draw from the air, and sun, and rain, and snow the choicest fertilizers, I can have patience with him, if he can't express the whole process in the barbarous hieroglyphics of chemistry. But he had better study a Chinese chemistry than not to know these things at all.

It won't do always to pride ourselves too much on experience. This is what sometimes makes a man set in his way, when owing to changed circumstances it is no longer the best way. Unless it is intelligent—that is unless it is based on the thorough cognizance of the immediate matter in hand and surrounding circumstances which affected it,—a too stiff reliance on experience may possibly mislead. Experience is not mere existence in time and space—not merely the lapse of years on a field of operation—but the actual and enlightened exercise of the appropriate facilities upon our opportunities. All that it tells us surely is what has been—we argue from it less surely as to what it shall be. And then we want to be certain that we know all the necessary conditions; otherwise our conclusions may be false.

In chemistry and the exact sciences an experiment may be enough to infer a rule, but we cannot so rigidly analyze all the manifold constituents of human experience in practical life. Here no two situations are precisely alike; nor does the same situation remain wholly the same. Changes are taking place on our farms which we are not apt to discover or take into account. As a general habit I

think we are farming on the system of our ancestors and taking the tradition of their experience as our guide. But what was true for them is not true for us. When the lands were new, and rich with all the nutriment that Nature had been providing for ages, it was well and wise to take advantage of it. A change however has taken place since, which we ought to understand. But now when the land will no longer do of itself what it used to, instead of understanding it and helping it, we spread our labor over twice the surface and then find fault with the whole and say farming will not pay for the labor. It took twelve starving horses on the "Mud March" to move a gun that was an easy load for six well fed. When for any reason it is cheaper now to clear new land than to renovate old, that no doubt is the best way to do. But one thing is sure, old land must be rejuvenated, exhausted elements restored, by skill as well as labor; that is, by art, which has its basis in science. That is what I meant by saying we want intelligence by which to carry on our experience, and the knowledge which gives us the result of experiments by others, and saves us the labor and loss.

We still hope that our Agricultural College will do something special for us. Yet we must not think it too exclusively an Agricultural College. It will serve its purpose and aid our farmers quite as effectually, if its course of study embraces all the mechanic and industrial arts. What a field for splendid achievement is there! I really wish we could have such a school and that everything local and personal and petty might be laid aside. This, however, is too much to expect, and pre-supposes the millennium to be pretty well advanced. We must be content to pay the price of those who will not learn from the experience of others. Whatever may be the difficulties of its beginning we must still look to it with earnest interest and expectation as the Institution which in a peculiar manner "comes home to our business and bosoms" and sheds its genial influence most widely among the people. Still they are few who can be actually educated there, and the place where most can be taught is the Common School. There only can you reach the mass of mind. There are few competent teachers now, so we must look to our Normal Schools—the teacher of teachers—to set the thing in motion, by introducing into their course some practical popular book on the Elements of Agriculture.

Association too is a great help to farmers—the mutual aid they

may render by debates, consultations and comparisons of experience. Here is the great benefit of your Agricultural societies, exhibitions and fairs, instructing and stimulating by friendly rivalries. The Reports of your State Board of Agriculture can hardly be surpassed for interest and value. The newspaper is a great teacher nowadays—perhaps *the* great teacher. To be sure the terrible "we" will now and then sit like the Grand Invisible Lama, and dogmatize and give his own private whim where you had a right to look for impartial, catholic criticism, or a fair statement of enlightened public sentiment. But we must bear the lesser evil for the sake of the greater good; for the great "We" is a good fellow after all, and knows a vast deal, and will often tell us some wholesome truths though they cut close home. Moreover he gives his best corner to the farmers of late, and where he gives you all the corners, as your "MAINE FARMER" does, nothing could be better. From all these means which are now in active and increasing exercise, intelligence must be largely deepened and diffused, and we shall soon have a tolerable science of farming, enough acquaintance with the nature and needs of soils to keep us from wasting our materials and our labor, and practical science enough at any rate to keep us from blasting through granite to find coal, or marrying a widow with a hill full of iron pyrites, thinking it is gold. "A little learning" certainly isn't "a dangerous thing," in such cases. By these means, too, the farmer will hit upon some system of his own by which he will make his vocation profitable and pleasant. It will depend upon circumstances whether you can best cultivate a large farm or a small one; on the locality, the age, the kind of soil, the nature and nearness of the market, or perhaps on some physical disability; whether, for instance, you have a bullet through your breast, or a wooden leg, or are an old bachelor. If your land will not pay for keeping up, let a good part of it go to grass, or even to trees again. It isn't the worst thing to have a lot of oak, or beech, or sapling pine, or even white birch and poplar growing. These last will do for spools and bobbins at any rate, and we are going to have a demand for these things pretty soon. I noticed on our marches through the magnificent oaks and chestnuts of Virginia, that in the midst of those immense forests wherever a tree had been cut out, the stump was fenced around with tender care to protect the little shoot springing up to replace the old. I don't call that bad Agriculture.

If you can't do one thing you can do another. If your land is impracticable in other respects, try sheep raising. In travelling in our South East counties a few weeks since, the aspect of the country being rather suggestive of this branch of industry, I asked my friends why they didn't raise more sheep? "We are afraid of the dogs," was the answer. And I have since learned that in the eight counties along our coast, more than two thousand sheep a year are actually killed by dogs, to say nothing of the number injured. There is a dead loss of ten or twelve thousand dollars a year in those counties alone. Our hungry boys were not afraid of Rebel sheep, I noticed, during the war, nor of Rebels either as to that matter, and to be kept out of a profitable business for any such paltry fear as this, shows that our friends there are more tender towards Yankee dogs than they used to be to Rebel sheep. It seems to me I would find a way to clear that track. If common sense didn't help me out, a little applied chemistry might do. But seriously, the low price of wool just now ought not to discourage sheep raising. If we attend to the mutton qualities as well as to the fleece, the farmer would find this a highly profitable business, and the farm would constantly improve under it. The readiness of the market would enable the farmer to make more money from his mutton and his wool together, than those do who are compelled to sacrifice everything to the fineness of fleece.

As to stock raising generally, we seem to be on the right road, excepting that it appears to me unfortunate to be obliged to send so many cattle to foreign markets. We ought to have use for them here—every part of them—setting in motion a score of handicrafts, and feeding at the same time both the factories and the workmen. Horses are our pride. But I suppose you will blame me if I intimate that we should not sacrifice everything to speed. Velocity is gained at the expense of power, and I question whether swiftness is the most urgent need nowadays. It might be the main point with "Young Lochinvar," or stray Congressmen at Bull Run. But strength, bottom, hardihood, action; these it seems to me should be counted among the prize qualities that go to make up blood. But I deem it a most fortunate thing that we are taking so great an interest in raising animals of choice blood. This is a business in which we may excel.

Such drift of thought as this I have had as touching upon the

aids and encouragements which the farmer has in striving to make his vocation profitable to himself and others. The best is that if he will begin in earnest, the example will react upon himself. A bold deed often gives courage, and a good one confirms virtue.

And think it not foreign to my subject, but rather the summary and climax of it all, to say we must aim in everything to keep our farmers' sons and daughters with us. Nobody that we can bring in, will make good the loss of these. Thank Heaven for the children—that the selfishness and sin of the cities has not yet struck its poison into the country—that Moloch is not God here. Thank Heaven that here there are yet fathers and mothers. The State owes them gratitude and honor. I would rather see a list of the women who had reared ten likely children than of the men who had paid $100 a year taxes; they are greater benefactors. They deserve a pension; but the beauty of it is such persons are never in need of it. If they have borne a cross, it is the cross of the Legion of Honor! There are two kinds of laboring—for our own profit which is selfishness, and for the profit of others, which is happiness.

Getting money isn't the chief good; those who think it is, sacrifice comfort or virtue to it, and find out their mistake. Think it no waste of your profits to improve and beautify your farms—to make your homes attractive to sense and heart. Such seed will bear fruit a hundred fold. We have not enough of the *hereditary* about our home notions. We don't build for the future. You hear men saying, "It will last as long as I do," and you can't help thinking it wouldn't be a great loss then if it didn't last very long. I suppose they think it is unconstitutional to have a family homestead—since "no hereditary distinction, privilege, honor, or emolument, shall be granted or confirmed" by the State. That is because the State doesn't want to usurp the rights of individuals. *You* can grant hereditary honors and privileges if you will, and bless your memory for it to coming generations.

It is of no use to talk of the dignity of labor. Labor will take care of its own dignity. What we want is the dignity of life, and the graces of the heart; more that is genial and social, a kindlier, brighter, daily living. Give us a hearth-stone again and a roof-tree, that a boy can no more get away from than his mother's prayers. And now is the time for all these things. Our young men have come home to us again. The war has taught them some-

thing. They have *travelled*—have seen the world a little or learned something of life and business and themselves. They know how little a man can live on, and how much he can live *for*. It was a great school—that war—to take the greenness out of boys and the meanness out of men! They are ready now for brave and noble deeds at home. Shall we drive them to seek elsewhere?

And if our farmers' sons forsake us, what is left for the daughters? The beneficent laws of nature are interrupted—the beautiful machinery of human society is thrown out of gear and goes jarringly and wrong. She whose aptitudes fit her for the thousand sweet and needful ministries of life—whose nature demands something stouter, and bolder, than she to lean on—finds no field for her chief virtues as a helper, and is thrown back upon herself. If this does not wholly break her spirit, she scorns to be dependent, and enters the lists of labor, to keep herself from being a burden, and to maintain her self-respect.

It is no derogatory thing for those whose circumstances make make it necessary to go into factories as operatives. But it does seem to me a pity for a farmer's daughter to go there. I know that good character will tell there, too, and that the excellent gentlemen who have charge of those institutions recognize the superiority of such service, and do everything to make the place worthy of it. But I do not know why it is not quite as well for a conscientious, earnest girl if she finds herself not useful at home, to go to a good motherly neighbor, and work with her, learning the duties which pertain to her future station and keeping in that honest, economical and womanly sphere and habit till she becomes a householder herself. Supposing she can earn more otherwise, it does not follow that this is worth most. One thing, however—people must remember that a girl has a heart as well as hands, and when she comes into their house she must find a home as well as a "place." If this good old practice could be re-established domestic life itself would be happier, and a girl would not think it degrading to serve an honorable apprenticeship because she might be called a servant. With the name changed we are all servants, and the higher we rise in station, if we rise in character too, the more we are servants. It is vexatious sometimes to be at every body's call, but there is a view of life and duty which makes true service to a fellow-being a thing honorable and great enough to satisfy any right ambition.

I think now of that young woman who came to me with her modest story on the train from Boston last summer. She was one of several daughters. Her father was a farmer in Maine and had a hard time to make a living. There was no need of her at home. She was ashamed to be an idler there and her father working so hard; and so had gone with his blessing and in the strength of her own good purpose, to find something she could do for herself in one of our large cities. She had not been pleased with her experience there, and was now on her way back to her father's, disappointed, humiliated, desperate almost, because she was unsuccessful. She said there must be some place in the world for a girl who wanted to do right, and begged me to tell her what to do, anything rather than go back to be a burden. Such a woman a burden! She was fit to be a blessing and a beam of light wherever she walked—to make some new hearth radiant with virtues—to shed comfort and peace over a whole neighborhood—to make the State itself better for her noble work and example. She would be angry with me of course if I thought of such a thing, but I should like to introduce her to a young man I know of—I hope there are more like him—who served nobly for his country's peace and honor, and bore home his scars and rankling bullets uncomplainingly; knowing well there were warmer soils and quicker fortunes elsewhere, but resolved to take the money left from his spilled blood and broken bones, and, as he said, "to make the old farm good, if it isn't so." That is the place to which such a girl should go from her father's house, not out into the world amidst the devourers that walk up and down; and that is the spirit we want.

"That young man will be heard from yet"—said the good Bishop to me the other day. If he isn't, it's no matter—the State and the world will be the better for him, whether he or you know it or not, and it makes me willing to stay here also, and do what I can for every body, when I know there are such young men in Maine. I see and feel, too, what Maine will be when more of such men stand up and say they will *make* her something.

The enterprise and power which now goes forth to work such wonders elsewhere may, if applied at home, make this a great and beautiful and happy State. The treasuries of nature opened; the forces careering about us applied to useful ends; all high industries set in motion, and Agriculture, Manufactures and Commerce advancing together in the union that is strength and the diversity that is prosperity! The State will feel this through all her giant

frame—she will rouse from her slumbers, every nerve and sinew braced for action—the sea lifting wealth on every surging tide shall be like a beating heart in her bosom thrilling strength through all her frame, and every river and avenue of motion become an artery of life.

I hope we may yet see this, and I know that if we do we shall owe it, more than to any one else, to the farmers and farmers' wives of Maine. Let us stand then in our lot where Providence has cast it, anxious for nothing but to be worthy of our opportunities, and diligent to do our duty, content with this goodly heritage of ours while we seek another and better country—that is a heavenly.

ANDROSCOGGIN COUNTY AGRICULTURAL AND HORTICULTURAL SOCIETY.

Secretary's Report.

This Society held their Seventeenth Cattle Show on land of the Franklin Company, having given up the Fair grounds to the purchasers, on Tuesday and Wednesday, October 13th and 14th, with good weather and a fair attendance, and a small but good show of stock. The smallness of the Show may be accounted for in a great degree from an idea in the minds of many that the Society was running down, and when we last spring had no place to call our own, it was said by many "The Society is dead." Others thought differently and felt determined to make a laudable effort to insure a good show, and they succeeded, although as against wind and tide.

There were two town teams of oxen. The team from Lewiston of 12 pairs received the first and the team from Webster the second premium.

There were town teams of steers from Webster and Auburn, one of which the Committee spoke of in high terms.

Of matched cattle there were sixteen pairs, making a fine display.

There was a good show of steers, also of bulls of various ages and of different breeds.

Of cows both for dairy and for stock, a fair representation; also two herds were on the ground.

Heifers also were exhibited in sufficient numbers to maintain their rank, and there were also beef cattle and the farm stock, so

that it was surely a good Show, and there is reason to believe that next year will bring a much better Show than this has done.

There were on the ground Mowers, Horse Rakes, Cultivators, Harrows, Plows, Seed Sowers, Gates and other articles of invention as labor saving machines.

The show of horses was quite small.

There was a fair lot of sheep—bucks and ewes, and of good breeds.

Of poultry—geese, ducks, turkies and hens were on the ground with their usual music.

Leaving the Show ground we come to the Hall, where fruits, flowers, vegetables, butter, cheese and goods of all descriptions meet the eye.

There was a fine display of fruit contributed by Messrs. L. Gilbert & Son, J. C. Moore, of Greene; E. P. Tobie, of Lewiston; J. C. Briggs, of Auburn; Thos. Herbert & Son, of Bristol, and others in smaller lots, consisting of apples, pears, quinces, grapes, &c.

Butter and cheese in large quantities were exhibited, also bread, both white and brown.

Of vegetables there were some good specimens. Potatoes—Early Goodrich, 294 bushels to the acre; also Sebec, Harrison and White Mountain, &c. Beets, turnips, cabbages and squashes attracted much attention. The exhibition of corn was very small from some cause, also of grain. Of wheat but two samples, and but three entries for crops of wheat, although we offered seventy-five dollars in premiums on wheat alone. The rains in spring washed badly and many did not get their grain threshed in season. The entries of crops of wheat were for less than two acres, therefore the premiums were but eight and five dollars of the whole seventy-five offered; but this movement will, we trust, succeed better next year, as farmers were not prepared to do much last spring in the culture of wheat.

Of manufactured goods there was a fine display, and also of household manufactures.

Our expectations were more than realized, and we feel that the Androscoggin County Agricultural and Horticultural Society still lives, and will prosper and make commendable progress.

We raised $591.45, notwithstanding the adverse circumstances.

Amount of premiums offered, $678.25; amount of premiums awarded, $352.50.

W. R. Wright, *Secretary.*

FRANKLIN COUNTY AGRICULTURAL SOCIETY.

Secretary's Report.

The Annual Show and Fair was held at the Society's grounds in Farmington, October 13th, 14th and 15th. The exhibition in all the departments was satisfactory and the attendance large. We had over seven hundred entries, showing an increasing interest. We feel that our anticipations have been more than realized and are satisfied that this, among the institutions of the day, is doing its good work.

The hay crop has been abundant, pastures good, and the growth of stock satisfactory to the farmer who looks to this as his main source of income.

Corn, though planted late (for May was a wet month, hindering all farm operations on land not remarkably dry,) was good.

More potatoes were planted than usual, but the *rot* prevailed, varying in different localities; in some cases farmers report the loss of one-half their crop.

Wheat—of this crop there has been a decided failure; very few bushels to the acre and of inferior quality.

It is but little use to sow wheat upon the intervales, the growth of straw is good but it will not yield more than from two to ten bushels per acre, while oats on the same land yield from forty to eighty.

The quantity of apples has been up to former years, but the quality not so good.

Our Society is in a prosperous condition. Thirty-seven new members have been added within the past year.

The address of Hon. F. G. Butler was excellent, imparting many valuable ideas of practical use to the farmer.

Amount of premiums offered, $434.25; amount of premiums awarded, $325.90.

P. P. Tufts, *Secretary.*

HANCOCK COUNTY AGRICULTURAL SOCIETY.

Secretary's Report.

For the first time, I was absent during the Exhibition, therefore cannot write from personal observation.

Our Society was unfortunate in having a cold, dispiriting rain throughout the second day, the dampening effect of which continued through the fair, yet paradoxical as it may appear, while financially it was a success, as an Exhibition it was not.

But for the experiment inaugurated in 1866, that of itinerate agricultural discussions, the Exhibition would have failed *in toto*; yet strange to say, a majority of the officers—if we are to judge by their acts—are hardly alive to the fact, else they would be more prompt to their appointments.

The Trustees offered $100 in premiums for wheat, and in response our farmers sowed a greater breadth than in any spring since that of 1845, but the unfavorable season, the extremes of cold and wet, the backward spring and the early autumnal frost, blighted the crop. *No complaint of midge.*

We have but few who make farming a *business*. The majority look to their farms for their potatoes, but to their trade, lumber, coasting or fishing for their bread.

Animals of high grade are increasing in numbers, with a few thoroughbreds. This department is hopeful.

Many of our farmers are learning the value of manure. Beside their own resources there is an increasing demand for commercial manures. More fish chum and superphosphate has been used the past year than ever before, and with satisfactory results.

One of the encouraging signs of the times is an increasing demand for agricultural reading. The Reports of the Board go off like "hot cakes."

Amount of premiums offered, $807; amount awarded, $538.

Samuel Wasson, *Secretary.*

NORTH KENNEBEC AGRICULTURAL SOCIETY.

Secretary's Report.

The time of our Annual Exhibition, as fixed in the by-laws of the Society, has always been the first Tuesday of October; but this year, after our bills were circulated and arrangements all made, we were compelled to postpone it one week, for the reason that the State Society, at short notice, took possession of the first week of October; so that we, with several other county societies, were compelled to get out of the way to prevent being run over. However, though some of our members complained at the time, and we were put to additional trouble and expense, yet as matters turned, we suffered no serious damage.

The weather was very pleasant, and our Exhibition proved to be one of the most attractive and successful we have ever held. A number of the animals on exhibition had already won high honor at the State Show; and it was the opinion of many who attended both exhibitions, that in neat stock, sheep, swine and poultry we beat the State exhibition in numbers, while in some of these departments we also excelled in quality. In horses, though our exhibition was both large and excellent, and full of promise in the young animals, the State Show, as was to be expected, had the advantage in numbers.

This proud showing is not to be wondered at while we number among our members such active and enterprising stock-growers as Lang, Gilbreth, Taylor, D. W. Moor, C. B. Gilman and a host of others, in the horse department; the Percivals, L. A. Dow, Henry Taylor, G. E. Shores, H. C. Burleigh, Winthrop Morrill, W. & W. Jones, Wm. Nowell, D. W. Moor, Wm. H. Pearson, and others, in neat stock, &c.

An accident to Mr. Lang's noble stock horse, Gen. Knox, was the only event that marred the otherwise very pleasant and profitable exhibition of 1868.

The exhibition at the Hall, which opened with a pleasant social gathering on Tuesday evening, as usual, was considerably below the average in most departments. Fruit, in this year of plenty in the apple orchards, was almost a failure; the household department was below the average; the entries in the department of

Fine Arts were few; and a similar record might be truthfully made of all the other departments with the exception of the Dairy. Of Butter and Cheese there was a rich display, embracing contributions from the well known dairies of F. A. Davies, E. Penney, Wm. E. Drummond, Abraham Morrill, E. W. Cook, J. B. Stratton, J. B. Clifford, Charles Stuart, J. B. Mitchell, Benjamin Mitchell, Wm. Balentine, Edwin Spring, Charles H. Hallett, and others.

It is proper to state, that in arranging the premium list this year, the Trustees, who seemed to be of one mind, made some radical changes; and it remains to be seen whether these will be approved at the next annual meeting. Refusing to discriminate in favor of pure bloods, they struck out all premiums to particular breeds, in neat stock, sheep and swine, and classed all together —full-bloods, grades, and natives. All were put upon the same footing, to compete for the same premium—Durhams, Herefords, Devons, Ayrshires, Dutch, Jerseys, etc., among neat stock; Merinos, South Downs, Cotswolds, Leicesters, fine, medium and coarse wool, etc., among sheep; and Chesters, Prince Albert, Suffolk, Essex, etc., among swine.

They professed to do this, partly on the score of economy—separate premiums for each class calling for too much money from the treasury of the Society. They also claimed to see danger to our present improved neat stock, made up principally of large cattle—Durhams, Herefords, etc.,—from the introduction of a diminutive breed like the Jerseys, which would give us neither beef nor working oxen. They also thought, honestly no doubt, that while trying to run our wool fine, there was danger of losing our mutton, and therefore they declined to encourage any longer the introduction of pure blood Merino sheep. While noting this change in the premium list, it is also proper to state that Mr. Lang, the President of our Society, and who is *ex-officio* a member of the Board of Trustees, had nothing to do with this change.

The lessening of the number of premiums operated, no doubt, to reduce the number of sheep on exhibition, and also kept some Jersey stock at home; but whether it lessened the usefulness of the exhibition or diminished the receipts, is for the members to decide. A separate show of Jersey stock was afterwards quietly made on our town common, without premiums. Over forty animals were exhibited, some of them very choice specimens. A Jersey stock-growing association is also about being organized by

several of our citizens, who are not disaffected towards the North Kennebec Agricultural Society, by any means, but are among our most active and valuable members.

Crops and the Season. A very wet Spring, with the rainy season prolonged to an unusually late period, so narrowed the time for planting that the breadth of land cultivated was much less than it would have been under more favorable circumstances. The severe drought of the past summer operated to diminish all the crops, in our section, unless perhaps, of hay. This crop, a leading one in Maine, was slightly above the average in quantity. Our farmers commence haying nowadays a fortnight or three weeks earlier than formerly; and the wisdom of this course was never more manifest than this year; for while the early cut hay was of excellent quality, much of the late cut was badly damaged, as well by rusting while standing in the field, as by being wet during the process of curing. Corn, which mostly matured, notwithstanding the early heavy frost, was rather light, owing entirely to the drought; and potatoes, though of most excellent quality, were no doubt diminished in quantity from the same cause. Wheat succeeded well; so did barley; and fair crops of oats were grown; all, however, affected by the drawback mentioned above. Of apples we had the best and largest crop raised for several years; and we are able to make the gratifying announcement that the caterpillar, which has been such a pest for several years, has almost entirely disappeared.

It may not be out of place to state that, encouraged by the success they have had of late years, our farmers are gradually giving more space to wheat. Spring wheat is the only kind grown, and it is of good quality, with an average yield surpassed by few States in the Union. Barley is gradually taking the place of oats, being found a much more profitable crop to raise.

Everything grown or manufactured on the farm has borne a good price, and with the improved facilities for transportation the farmer finds a market close to his door; surely he ought to prosper, and his prosperity should make him grateful.

Amount of premiums offered, $712; amount of premiums awarded, $414.

Daniel R. Wing, *Secretary.*

KENNEBEC UNION AGRICULTURAL & HORTICULTURAL SOCIETY.

SECRETARY'S REPORT.

This Society held its Sixth Annual Cattle Show and Fair at West Gardiner, October 21st and 22d, 1868. The weather was unfavorable, being very cold and windy both days. The postponement on account of the State Fair proved a disadvantage.

The show of stock was good, but in numbers it did not come up to former years. One pair of three years old steers exhibited by Hiram Pope, of West Gardiner, over seven feet in girth, attracted much attention from lovers of good stock. The Pittston town team of eleven pairs, averaging seven feet in girth, was awarded the Societies' first premium. The show of full bloods was good, among which were Ayrshires, Devons and Jerseys. J. F. Bragdon, of Pittston, exhibited his one year old Devon bull, that took the first premium at the State Fair.

Of sheep there were some fine specimens of Spanish Merinos, shown by J. Blinn, of Dresden, and South Downs by J. M. Carpenter, of Pittston.

The show of dairy products and domestic manufactures was unusually small.

The show of fruit was good for this season.

Amount of premiums offered, $530.70; amount awarded, $269.14.

S. SMILEY, *Secretary*.

EAST KENNEBEC AGRICULTURAL SOCIETY.

Secretary's Report.

This Society was organized April 4th, 1868, and it was only by the most persevering efforts that we were able to prepare the grounds so as to hold a Show and Fair this season.

The First Annual Show and Fair of the Eastern Kennebec Agricultural and Horticultural Society, was held at China, Oct. 20th, 21st and 22d. The weather was very unfavorable, yet considering the circumstances, the Show passed off very pleasantly and satisfactory to all.

There were about twenty entries of thoroughbred animals, chiefly Durhams. Warren Percival was the principal exhibitor in this class.

There were rising forty entries of horses and colts, and a fair display of articles in the Hall.

Five towns are included in the limits of this Society, in a strictly agricultural district, and the object of the Society is the promotion of agriculture. The principal crops raised are hay, corn and potatoes. Some wheat is raised, the principal objection to its culture being the midge and rust.

There seems to be an increasing interest in farming since the war. Farmers are beginning to turn their attention to the improvement of stock, a desideratum heretofore much neglected.

H. B. Williams, *Secretary*.

NORTH AROOSTOOK AGRICULTURAL SOCIETY.

Secretary's Report.

This Society held its Annual Cattle Show and Fair at Fort Fairfield, Sept. 30th, and Oct. 1st, 1868. I am unable to make much of a report this fall, owing to being sick at the time the Show was held.

At our last annual meeting, by the earnest request of the portion of our Society at Fort Fairfield, it was decided to have the Show and Fair there this fall, consequently it was small, owing to its being at our extreme limits one way, making it too far for a large portion to attend and drive their stock. But it was said the show was good, especially of horses, and the Fair at the Hall was much larger and better than it has been for several years past.

The farmers of Maysville held a town show by themselves the last of October, which was a great success. The show of neat stock, sheep and swine, could scarcely be beaten by any one town in the State. Also the show of crops, dairy products, household manufactures, &c.

Our farmers have been signally blessed the past season with great crops, the greatest ever raised in this county, and I doubt not even in the State, especially the wheat, bean and potato crop. Our farmers are turning their attention more to wheat growing than in former years, and with good success.

It is hoped that the members of this Society in the future will manifest more liberality; look to the interest and growth of the Society; be united and hold their Shows and Fairs at the place where it will accomodate the greatest number; as we grow in prosperity, and in the future we shall have a larger and more prosperous Society.

Amount of premiums offered, $215; amount awarded, $168.

Amasa Howe, *Secretary.*

OXFORD COUNTY AGRICULTURAL SOCIETY.

Secretary's Report.

The Twenty-sixth Annual Exhibition of this Society was held on the Societies' grounds, on Tuesday, Wednesday and Thursday, Oct. 6th, 7th and 8th, 1868. The weather was favorable, but the postponement of the State Fair operated unfavorably. A large number of people intended to attend both fairs, previous to the postponement of the State Show, but after that event they gave up ours and attended the one at Portland. Our exhibition of horses was as large as that of last year, but the display of neat stock was less. Notwithstanding the falling off in the number of entries, many fine specimens were on the grounds. The number of sheep and swine entered was small.

The exhibition of dairy products was not such as its importance demands. Although the number of entries was small, excellent specimens were to be seen.

A large amount of domestic manufactures was entered, but the display of needlework, millinery, boots, shoes, agricultural implements and furniture was meagre. The leading feature of our Fairs is the exhibition of neat stock. They are emphatically Cattle Shows. The most important crop grown here is hay, as other crops are, in a great measure, dependent upon it. The hay crop was very large. Corn, wheat, rye, barley, oats, potatoes and other roots are all important crops. But the apple crop affords more net profit than any other grown in the county. We always have a good display of apples at our Fairs. The Trustees have been making efforts to increase the interest in field crops, but thus far without success. They offered largely increased premiums on wheat, in accordance with the directions from the Board of Agriculture, but they elicited only a single entry. One entry only was made for a crop of corn, and one for potatoes. No entry was made for rye, barley, or oats. No statement was made in relation to the entry for a crop of corn, and consequently no premium was awarded. A large number of specimens of seed corn were exhibited, many of which were very fine. The exhibition of vegetables was good.

Among the obstacles in conducting an Agricultural Society, is

the difficulty of obtaining awarding Committees who *will do their whole duty.* We find some Committees who are prompt to examine and decide, and who will make a report that is worth reading. Others are dilatory and late in making their examinations and decisions, and report only the sums awarded. Another obstacle is the want of interest among competitors for premiums. Many of them seem more anxious to obtain a premium than to impart information in their statements.

Amount of premiums offered, $389.50; amount awarded, $272.85.

ELLIOT SMITH, *Secretary.*

WEST OXFORD AGRICULTURAL SOCIETY.

SECRETARY'S REPORT.

The eighteenth exhibition was held at the Society's grounds in Fryeburg, October 13th, 14th and 15th. It was one of the most successful shows ever held by this organization. The premium list was thoroughly revised, and made attractive to exhibitors, and the season had been replete with abundant harvests.

The display of neat stock was unusually large—more than four times that of 1867. Two town teams and one herd of cattle were entered from Fryeburg. The Jersey is more and more becoming the favorite stock of farmers in this society for docility and as butter producers. The amount of premiums offered in this department was $210; the amount awarded $106.50, against $46.50 awarded a year ago. The number of horses was also largely increased, and an advance in quality could readily be noted over former exhibitions—$53.75 were awarded for horses and colts.

Several kinds of agricultural implements were on exhibition, such as mowing and raking machines, plows and cultivators, &c. In the town of Fryeburg alone there are now in successful use about one hundred mowers, including fifteen or twenty different patents, and none decidedly inferior or unworthy. Other towns within the limits of the Society are not quite so favorably situated for their general introduction.

Hay came in abundantly—the grasshoppers having entirely disappeared. Owing to the lateness of the premiums offered under the instructions from the Board of Agriculture for wheat, but few

could avail themselves of the extra inducements this season, but it is presumed another year more wheat will be sown.

Fine samples of corn were entered the yield having been good in this region. Three entire crops were entered which harvested respectively 108, 100 and 83½ bushels of shelled corn to the acre. The two first, C. B. Smith's of Denmark, and James Walker's, Fryeburg, subsequently took the first and second premiums at the State Fair in Portland.

Potatoes were abundant, but some farmers complained of their inclination to decay.

Fruit was presented in great abundance. About one hundred varieties of apples alone, exceeding in quantity and quality that at the State Fair.

The most prominent feature in the Hall was the display of domestic and fancy manufactures by the housewives, and ladies in general. Numerous quilts, carpets and rugs lined the walls, while the "homespun" abundantly covered the tables. Upwards of $100 was awarded to articles in the Hall.

In conclusion it can be said, without any hesitancy, that there was more interest manifested than ever before, and better harmony and good feeling prevailed. Many who were wont formerly to denounce the character of such exhibitions and class them among evils, are now freely coming and seeking admittance as members. This Society has from the smallest beginning made its way to its now prosperous condition, through the dint of good management and hard labor on the part of some of its members. They now own the grounds and buildings, valued at some twelve or fifteen hundred dollars, free from incumbrances, and moreover have a balance in the treasury. It can therefore be plainly seen why the croakers are coming back—the risk is nothing now. Another season it will be necessary to rebuild the fence, and at the same time we shall enlarge the track, which will take about all the surplus funds.

Amount of premiums offered, $508; amount of premiums awarded, $294.

D. Lowell Lamson, *Secretary.*

EAST OXFORD AGRICULTURAL SOCIETY.

Secretary's Report.

The Annual Exhibition and Fair of the East Oxford Agricultural Society was held at East Rumford, Oct. 7th and 8th.

There was not so much neat stock on exhibition as usual, but the oxen and steers were highly creditable to the exhibitors. The raising of this kind of stock pays well, especially those of good quality and well matched. There is a commendable competition among our farmers to be able to present the best at the Society's Exhibition. If our farmers would be more particular, and raise those only of the best quality and in the best manner, it would be greatly to their advantage.

The exhibition of cows and heifers, I am sorry to say, was rather meagre, though this is an important part of stock raising. There were some very good bulls.

There were a few very good bucks. It is said by farmers generally here, that sheep raising does not pay so well as stock raising and the dairy; but perhaps when thoroughly tested for a series of years, taking everything into consideration, this opinion might be changed.

There was a good exhibition of dairy products, and a lively competition for the premiums. The dairy has of late been very profitable to those engaged in it, but has not the cow had the credit of a portion of the hard labor of the farmer's wife? and is it not an open question yet, which gives the most real profit, after deducting the excess of labor in the dairy, this or sheep raising?

There was a good exhibition of horses and colts.

The fruit and vegetable department was rather low, though there were some good specimens of different varieties.

Domestic manufactures and needle-work were good, and creditable to the ladies.

There has been a decided improvement in agriculture generally, during the last few years, and farmers by giving their attention to the business can and will succeed.

Hay, corn and potatoes were generally good in this section. Wheat very light. Many here doubt the propriety of our Agricultural Society being required to expend so large a portion

of our means in premiums on wheat crop. The oat crop was very light here.

Amount of premiums offered, $222.75 ; amount of premiums and gratuities awarded, $132.33.

WEST PENOBSCOT AGRICULTURAL SOCIETY.

Secretary's Report.

The Fourteenth Annual Cattle Show Exhibition and Fair of this Society was held upon the grounds of the Society in Exeter, Sept. 29th and 30th, and Oct. 1st, 1868. The weather was fine but cool, and the attendance large; 618 entries were made, and taken as a whole, it was one of the most successful exhibitions ever held by the Society.

The first day was devoted to the exhibition and examination of cattle, sheep and poultry. There were 55 cows and heifers, 14 bulls, 21 pairs oxen and 38 pairs steers on exhibition, mostly of grade Durham and Jersey.

Pure bred animals, introduced into the State the present season, were exhibited by A. S. Barton, of Dexter; Durham bull, "Waterloo, 7,369; calved April 7, 1867. Page 221, A. H. Book;" also a yearling heifer of same breed. By Charles Shaw, of Dexter, Durham bull two years old and a yearling heifer of same breed. These animals attracted much attention, and were considered an acquisition to the stock improving community. Wm. Plaisted, Jr., of Stetson, exhibited four heifers of the Dutch breed, two yearlings and two 2 year olds, which were judged good specimens of that stock.

Stephen D. Jennings, of Garland, exhibited 1 pair oxen 5 years old, girth 7 feet 6 inches, weight 3,760 pounds; L. A. Davis, Exeter, 1 pair 4 years old, 7 feet; town of Exeter, town team, 8 yoke 5 years old, average girth 7 feet 5-8 inches; Henry Amazeen, of Garland, 1 pair fat oxen, 7 feet 9 inches; Joel Richardson, of Corinth, 1 pair steers 3 years old, 7 feet; R. W. Doe, of Corinth, 1 pair steers 2 years old, 6 feet 4 inches, and S. A. Hamilton, of Garland, 1 pair yearling steers 6 feet, weight 2129 pounds.

There were 150 sheep, mostly of the grades Cotswold, Spanish Merino and South Down. Charles P. Church, of Bradford, exhibited a Cotswold buck, a very fine animal of large size.

For the first time, I believe, since the organization of our Society, the swine department was unrepresented. Poultry had very good specimens of Bramahs, Golden Pheasants and turkeys.

The second day the exhibition and examination of horses came in order and well sustained their high reputation.—96 entries, 48 under 4 years old.

The exhibition in the halls was excellent. The entries in this department numbered 262. The ladies' department of substantial household-made fabrics of woolen, cotton and linen goods was more bountifully supplied than at any former exhibition, the tables being loaded with large pieces of fulled cloth, cassimeres, flannels, dress plaids, shirtings, frocking and carpeting, while on the walls and over the tables were displayed coverlids, quilts, counterpanes, hearth rugs, hose and mittens and a fine display of needlework, fancy articles and paintings, all showing increased interest by the exhibitors.

The fruit department was filled with choice specimens. E. C. Tebbets, Exeter, 24 varieties apples and one of cranberries; John Andrews, Exeter, 24 varieties and one bushel apples; Russel Murdock, Garland, 17 varieties and 2 bushels apples; C. C. Hind, Exeter, 18 varieties; C. T. Carlton, Dexter, 17 varieties; William Grinnell, Exeter, 12 varieties; Mrs. T. R. Shaw, Exeter, 3 varieties pears and apples; J. P. Sinclair, Levant, large display of apples, pears and grapes; E. F. Crane, Kenduskeag, apples and grapes; C. B. Wood, Stetson; H. S. Dole, Dexter; J. Campbell, Corinth; M. Tebbets, S. Hardy and N. E. Brown, of Exeter, made fine displays of fruit.

Honey, maple syrup and sugar, preserves, jellies, wines, bread, boquets and works of art made a good display. The exhibition of butter and cheese, numbering 21 packages of butter and 19 of cheese, all of excellent quality, reflected much credit to the producers.

Crops. In this department fine specimens were on exhibition, and the statements furnished present the following: Wm. Grinnell, of Exeter, produced 36 bushels wheat from 2 acres, valued at $90.00,—profit $62.50; 200 bushels ears corn from 2 acres, valued at $125.00,—profit $61.00; 525 bushels potatoes from 3 acres, valued at $315.00,—profit $226.00. Hall Bagley, of Charleston, 23¾ bushels wheat from 1 acre, valued at $64.20,—profit $41.20; 200 bushels ears corn from 2 acres, valued at $125.00,—profit $75.50; 9½ bushels beans from ½ acre, valued at $28.50,—profit $16.75; 15

bushels of buckwheat from half an acre, valued at $22.50,—profit $13.85; 185 bushels potatoes from 1 acre, valued at $114.60,—profit $72.60. John Bagley, of Corinth, 21½ bushels wheat from 1 acre, valued at $43.00,—profit $25.25; from another acre, 47 bushels oats, valued at $35.25,—profit $13.75; and from another acre, 272 bushels potatoes, valued at $163.20,—profit $115.70. E. B. Stackpole, of Kenduskeag, 17½ bushels wheat from 1 acre, valued at $43.75,—profit $25.40; and from ½ acre, 13 bushels, valued at $32.50,—profit $16.50; from 1 acre, 27½ bushels buckwheat, valued at $33.75,—profit $23.40; from another acre, 27 bushels oats and peas, valued at $27.50,—profit $22.54; from ⅝ acre, 79 bushels ears corn and 8 bushels beans, valued at $81,37,—profit $69,22; from ½ acre, 8⅞ bushels beans, valued at $35.50,—profit $26.13; from 3 acres, 506 bushels potatoes, valued at $354.20,—profit $244,65; and from ½ acre, 112 bushels potatoes, valued at $78.40,—profit $65.35. John Andrews, of Exeter, 1078 bushels potatoes from 5 acres, valued at $722.26,—profit $514.42; from 2 acres, 254 bushels ears corn, valued at $177.80,—profit $133.30. C. C. Hurd, of Exeter, 204 bushels ears corn from 2 acres, valued at $182.80,—profit $115.80; 410 bushels potatoes from 3 acres, valued at $246.00;—profit $181.40; and from ½ acre 7 bushels beans, valued at $24.50,—profit $18.00. E. C. Tebbets, of Exeter, 87 bushels ears corn ½ acre, valued at $60.40,—profit $30.05; and from ½ acre, 16 bushels beans, valued at $56.00,—profit $29.05; Wait Cheney, of Corinth, 235 bushels potatoes 1 acre, valued at $152.75,—profit $113.25. Crosby Clements, Kenduskeag, 182 bushels potatoes from 1 acre, valued at $120.80,—profit $80.25. E. F. Crane, Kenduskeag, 33 bushels barley from 1 acre, estimated profit $40.00; from another acre, 114 bushels ears corn, estimated profit $60.00; from another acre, 320 bushels potatoes, estimated profit $180.00; and from another acre, 40 bushels oats, estimated profit $35.00. Stephen Steward, Newport, 913 bushels potatoes from five acres, and 9½ bushels beans from ½ acre. Jacob Eastman, of Exeter, 15 bushels wheat from 1 acre; 213 bushels potatoes from another acre, and from another acre 117 bushels ears corn. Hammond Eastman, Jr., of Exeter, 80 bushels oats and peas from 2⅛ acres, and 122 bushels ears corn from 1 acre. D. M. Haskell, of Garland, 19½ bushels buckwheat from ½ acre; 182 bushels ears corn from 1½ acres, and 221 bushels potatoes from 1 acre. John Campbell, of Corinth, 205 bushels ears corn and 10 bushels beans from 2 acres. Edwin S. French, of Exeter, 130 bushels ears corn

from 1 acre. N. E. Brown, of Exeter, 234 bushels potatoes from one acre, and 124 from ½ acre. J. C. Lawrence, of Garland and William Plaisted, Jr., of Stetson, exhibited fine specimens of early Goodrich potatoes, and the display of garden vegetables was very good. Nearly all the competitors in this department make farming their principal business, and make a practice of exhibiting the result of their labor at our Fairs.

At 2 o'clock on the second day, Ezekiel F. Crane, Esq., President of the Society, delivered an address which was listened to with marked attention, at the close of which the several committees reported their list of awards, which were accepted with satisfaction by the exhibitors and members of the Society.

Amount of premiums offered, $723.75 ; amount of premiums and gratuities awarded, $397.25. On horses, $60.50 ; oxen and steers, $42.00 ; cows and heifers, $45.00 ; bulls, $24.50 ; sheep, $21.25 ; poultry, $2.00 ; drawing, $6.00 ; butter and cheese, $17.25 ; fruit, $20.85 ; honey, &c., $6.75 ; implements, &c., $11.75 ; manufactures, $48.10 ; crops, $91.30.

The third day, set apart for the exhibition of trotting horses, was well attended and passed off with great satisfaction.

T. P. Batchelder, *Secretary.*

NORTH PENOBSCOT AGRICULTURAL SOCIETY.

Secretary's Report.

Our Annual Show and Fair was September 23d and 24th at Lee Village. Although not an entire failure it was nearly so in consequence of very rainy and otherwise bad weather. Arrangements had been made for a full and interesting show, but we were sadly disappointed. The stock presented came from the immediate vicinity and did not compare favorably with other years.

In the Hall were few articles but very good and substantial, embracing very fine samples of butter and cheese, excellent cloth, carpeting, rugs, &c.

Fruits and vegetables meager.

The past season has not been so favorable to the farmer as we sometimes have. The very wet spring prevented many from planting and sowing as early and as much as was intended, yet the crops were very good and the husbandman has been well

remunerated for his toil. The high price of flour and the unusual premiums offered have stimulated many to sow a greater breadth of wheat than usual—*for which we have been well repaid.* The surest crop with us is corn to which more attention is paid than formerly. They crop good and well secured.

Potatoes are raised in abundance and of very good quality, worth from fifty to seventy-five cents per bushel. Everybody has raised beans—worth from $3 to $4 per bushel.

Amount of premiums offered, $384; amount of premiums awarded, $175.

SHEPARD BEAN, *Secretary.*

PISCATAQUIS CENTRAL AGRICUTURAL AND HORTICULTURAL SOCIETY.

SECRETARY'S REPORT.

The Exhibition of this Society was held upon the grounds of the Trotting Park Association in Foxcroft on the 7th and 8th of October, 1868.

Unfortunately the State Fair being held the same days, caused the absence of some of our active members; yet the exhibition was one of profit, and very satisfactory to the Society. The show of stock in numbers and in quality was as good as former shows.

There were two very excellent town teams of oxen exhibited; one from Dover by Sanford Dinsmore, and one from Foxcroft by Leonard Robinson, the latter receiving the first premium. The greatest interest of the Show was on the first day, on the drawing of oxen and horses, there being a larger number of competitors than usual. Mr. Henry Chapin of Monson, exhibited two pairs draft horses, which greatly excelled former teams of the kind exhibited, being well matched for size, temper, and color. Cows and young stock showed quite an improvement from former years, especially in the matching of young steers.

The number of horses and colts was as large as usual, and showed marked improvement in breed and condition.

The show of sheep and swine was smaller than usual; the low price of wool the past season (forty cents per pound) having reduced them in the estimation of our farmers, behind all other farm stock; the same is true of swine, the low price of pork last

year, and the high price of produce, caused the wintering of less than one-half the number usually kept.

The show of fruit was less than in former years, owing in part to the lack of a convenient room to display them—the same also was true of vegetables.

Crops in the County. The yield of hay was more than an average, the principal part being secured in good condition. In consequence of dull weather a portion of it was late cut, though not otherwise badly injured.

Grain of all kinds is very light, not over half a crop in quantity, and generally poor in quality. A large part of the wheat was sown early, just before the extremely heavy rains, and consequently much of it never germinated. What came up, made a fair growth, and the kernels were of average plumpness, but the yield per acre was very small, not averaging over eight bushels. There was little complaint of the midge and very little from rust. The late sown gave altogether the best yield. The result is not against profitable wheat raising in Maine. The small yield was not due to causes that are likely to occur another year, but were such as affected other grain as well as wheat. Late sown oats produced little but straw. The society offered large premiums on wheat, by the direction of the Board of Agriculture, but the yield being so very light, there was but one entry made, and that by Mr. Frank Hart S. Howard, for seven bushels grown on 97 rods of ground.

Corn was above an average, sound and well secured. It is one of our surest crops.

Potatoes did not yield quite up to an average crop; the quality, however, is very good, much better than last year. In unfavorable soils they rotted so badly that nearly one-half were unfit for storage and much complaint is heard of rotting in the cellars.

Fruit is not abundant though a little above last season.

Pasturing has been good during the season and stock has made a good growth. On dairy farms large quantities of butter and cheese have been made. Thus, though some of our crops are light, we have a goodly income from our stock, and abundant supply of hay to winter it on.

Our Society had twenty-one new members added during the year. Amount of receipts at the Fair was $489.34. Amount of premiums offered, $316.34. Amount awarded, $276.23.

LYMAN LEE, *Secretary.*

SHAPLEIGH AND ACTON AGRICULTURAL SOCIETY.

Secretary's Report.

The Annual Fair of our Society was held at Acton Corner, October 20th, 21st and 22d. The weather proved to be very unfortunate for our purposes, as it was cold and rainy most of the time; notwithstanding, there was a very fair attendance each day. The exhibition was all we could reasonably expect. Of working and matched oxen there was a large number of entries, and received much praise for their many good qualities. Steers, cows and heifers were fully represented, all showing that our members are awake to the importance of keeping good stock. Horses and colts were out in strong force. Two days of the Fair were almost wholly devoted to the exhibition of horses, to show their usefulness, speed, or future promise of excellence. There may be a doubt, perhaps, as to the propriety of appropriating so large a share of the time to this purpose, but it is the spirit of the age, so we meekly submit.

Farm produce as usually cultivated by back town farmers, was brought forward profusely. The samples of corn and potatoes were especially fine. Premiums were awarded for corn which yielded at the rate of upwards of 80 bushels per acre, and for potatoes at 270 bushels per acre. The wheat crop for the present year has been poor. The highest entry made for the acre was 17½ bushels. Our farmers seem to have no regular method in regard to raising wheat. Some plow in the fall, some in the spring—at a depth of from four to nine inches. A few manure the land especially for the wheat, but most do not. The usual way is to break the land up from the sward and plant one year to potatoes. The second year manure the land and plant to corn, and the third year to sow wheat at the rate of from one to two and a half bushels per acre. There are but few farms where wheat is a sure crop. These are situated mostly on ridges of land and are under a high state of cultivation. It is the generally received opinion that early sown wheat yields best.

There has been a very fair crop of apples, numerous specimens of which were shown fully equal to any ever produced in these towns. Much interest is manifested in the cultivation of fruit.

Many farmers are setting new orchards and if proper care is taken with the young trees they will find it a profitable investment.

The Baldwin is the favorite winter variety; being for good keeping qualities and productiveness without an equal. The Spitzenburg is highly valued as being of finer flavor than the Baldwin but not so good in other respects. Russets do not stand very high with us, though trees in an extra location do well some years. As a general thing the fruit is apt to be small, knotty and scanty. The Northern Spy, Hubbardston Nonsuch, Canada Red, Greenings, &c., are grown to some extent. Summer and fall apples are cultivated mostly for home use. Sops of Wine, Sweet Bough, Garden Royal, William's Favorite, Benoni, Porter and Fall Harvey all rank high. William's Favorite is perhaps the most esteemed as a safe apple for market. There can be no certain rule given for successful fruit growing, but there are some localities where it is useless to attempt orcharding. No one need expect much of fruit trees planted on cold wet land where water stands near the top of the ground a large part of the year. It requires a deep, warm soil, manure, and a plenty of care to succeed in the business.

Pears, peaches and grapes were presented, all looking tempting, and we fear from their mysterious disappearance proved too much so for the honesty of some of the lookers-on.

There were many entries of potatoes. Jackson Whites and the new seedlings seemed to take the lead. Several lots of Early Goodrich were well spoken of, though they are not so early as they have been represented to be, nor are they the best for table use. Their productiveness is their best quality. There has been some complaint of rot in potatoes this year but there has been a fair crop secured. Many fine lots of beets, onions, turnips, pumpkins and squashes made an excellent display. Numerous samples of butter were entered of the best quality, speaking well for the skill, neatness and care of the makers. The ladies' department was full to overflowing with choice samples of their cunning handiwork. Carpets, rugs, quilts, shawls and fancy articles "too numerous to mention," which received the praise of all beholders.

A choice collection of flowers added much to the attractiveness of the Hall.

Our Society now numbers upwards of 200 members, all in the two towns of Shapleigh and Acton. The Society is out of debt and has money in the treasury. The Society held its Exhibition

on the grounds of the Acton Trotting Park Association. The gentlemen of this association have at large expense erected suitable buildings, prepared a track and built a fence around the whole, and have entered into a very liberal arrangement with the Society so that the exhibitions can be held on their grounds.

We find the result of our Fairs to be that farmers try to obtain better stock, have more care to grow larger and better crops. In fact it acts as a vigorous stimulant to greater and more systematic exertions in every department of farming. We do not expect to conduct a society so that there will be no grumblers, for in the best of management there will occur some mistakes, and with some people explanations are useless. While all human institutions contain some evil, we believe that our Society has wrought but little evil, and has produced great good.

JOEL B. RICKER, *Corresponding Secretary.*

PENOBSCOT AND AROOSTOOK UNION AGRICULTURAL AND HORTICULTURAL SOCIETY.

SECRETARY'S REPORT.

The Annual Fair of the Penobscot and Aroostook Union Agricultural and Horticultural Society, was held at Patten, on the 14th of October.

The collection of animals was not so large as in some past years. There were many valuable horses, oxen, cows and sheep on exhibition. There has been an improvement in the breed of these animals, in consequence of the efforts of the Agricultural Society.

Mr. S. S. Thompson presented a fine stallion of the Clydesdale breed, which took the first premium. The young stallion presented by Joseph S. Hall, of the Morgan breed, took the second premium. Several breeding mares with their colts were on exhibition. The mare and colt belonging to Ira Fish, Esq.—Messenger—were by many thought to be the best on the ground. Mr. Ash's Clydesdale mare took the first premium. She was large and showed some large colts. The Committee say there were 21 colts on exhibition, all fine animals. They were much perplexed to tell where to award the premiums. Mr. Ash's colt was large and took the first premium.

Several pairs of working oxen were on the ground. Mr. Andrew McCourt took the first premium. Some of our farmers take much

pride in owning large oxen, and in having a good team. Oxen are more profitable than horses for farm work; they are kept cheaper. They may be kept so as to be constantly increasing in value, and when put on sale bring a good price.

Mr. Nathan Dwinal's 3 year old steers were well mated, large and beautiful, and measured on the girth 6½ feet. They took the first premium. The boys showed a team of 18 pairs of one year old steers, and took a premium of fifty cents for each pair.

The Committee on cows report that J. Ordway, H. N. Darling and E. Blake each exhibited cows that were worthy of notice, besides those which took the premiums. Mr. Ezra Blake took the first premium, and J. Cunningham the second on dairy cows.

Within the limits of the Society are many good flocks of sheep. They are grades of Leicester, South Down, Oxford Down and Cotswold. The long wool sheep, as the Leicester and Cotswold, are by many thought to be the most profitable, because they produce the most pounds of wool.

But few entries were made for premiums on crops. Corn is considered a sure crop, though it is not largely cultivated in this region. Mr. Jesse Craig, of Island Falls, made the following statement:—In the spring of 1867 I spread twenty ox cart loads of green manure on a clover sod and plowed it under, and set it to apple trees one rod apart and planted it to potatoes. In the fall I spread on about 20 loads of summer manure and plowed it shoal. In the spring spread on about 20 loads of green manure and plowed it again and planted it to corn 3½ feet by 3 feet and beans, with pumpkins interspersed. Hoed it once and partially again. (Perhaps Mr. Craig made a mistake in planting his corn so far between the hills and rows. If he had put his hills and rows nearer, probably his crop would have been increased. Stalks in this region grow small and will bear planting near together.)

The wheat crop this year has been good, and it is said to be the most profitable crop raised. Our farmers who are most successful in raising wheat, summer-till their land. On land which is not too much exhausted by cropping, they plow in a crop of grass in June or July and harrow it well. The grass and roots rot and supply that kind of nourishment which the wheat needs to make it thrifty. Some cross-plow in the fall and early in the spring sow the wheat, two to three bushels to the acre. Mr. Milmon, of Benedicta, says he has not failed to raise good wheat for the last 15 years, on the summer tilling plan. Wheat sown early is less likely

to be injured by rust or midge. Mr. Gardner Roberts, of Golden Ridge, Sherman, raised this year 100 bushels of good wheat and 375 bushels of buckwheat. He will not patronize the railroad nor Bangor teams this year, to supply his family with flour. Golden Ridge has many farms equally as good—why not raise the wheat? Mr. Roberts is what we call a forehanded, independent farmer. He commenced on Golden Ridge about eight years since, poor, with a large family. Golden Ridge contains much gold in the shape of wheat—who will dig for it? Mr. Joseph S. Hall, of Patten, raised 31½ bushels of wheat this year on one acre, on land on which he raised potatoes last year. Mr. Ephraim Jay, of Patten, raised 90 bushels of good wheat on three acres of burnt land this year. Mr. Edmund Jay raised on his farm this year 89 bushels of good wheat. These Jays have a wonderful faculty of digging gold and greenbacks out of their farms, in the shape of wheat, oats and other good crops.

Beans are a profitable crop. Mr. H. N. Darling raised this year 20½ bushels of beans on two-thirds of an acre, from which he realized a profit of $56.00. He plants a white pea bean which matures early and gets ripe. Mr. James E. Parker, of Patten, raised 8 bushels of beans on one-fourth acre, which sold for $3.50 per bushel.

The potato crop has been good this year. Mr. H. N. Darling raised on one-half acre of land 194 bushels of potatoes. He put on to the half-acre eight cords of manure. He figures a profit of $47 on the half-acre.

The hay crop was abundant. Our farmers will probably overstock their barns and hay will be high before grass grows again. The hay crop is that on which the farmer has to depend principally for success. If he has a large barn well filled with hay, and stock enough around it to consume it all, he cannot well help to make farming profitable.

The dairy business this year has been profitable, and dairy products sell high and quick.

Though prices are high for labor and everything else, yet farming was never better than it is now in this region. In this Aroostook county are thousands of acres of good land, on which young men with a strong arm may make themselves, as regards property, as well off as the best.

Amount of premiums offered, $144; amount awarded, $88.

LUTHER ROGERS, *Secretary.*

WEST SOMERSET AGRICULTURAL SOCIETY.

Secretary's Report.

The Annual Exhibition of the West Somerset Agricultural Society was held on the show grounds in Anson, October 14th and 15th, 1868. The weather was fine and the attendance of people very large. The Show was not so large as sometimes; but the lack of quantity was amply made up in quality. It is noted that every succeeding exhibition shows a marked improvement in Farm Stock. One striking feature of the Show was the exhibition of the entire herds of W. W. Pease, Joshua Hilton, and Elijah Hilton—all of Anson. There were more thorough bred animals exhibited than usual; distinct and larger premiums having been offered on this class. The Durhams still lead, but quite a large sprinkling of Herefords, Devons and Jerseys were shown.

The Horse interest was largely represented, and the show of horses and colts very large. Some object to so much horses, and the influence of horse-trotting on the Agricultural Societies; but it is no use so long as a "fast" stepper, as also good carriage horses bring present prices, and are so eagerly sought for.

The exhibition of sheep was smaller than common; there were some fine specimens of Merinos, Leicesters and Cotswolds, bucks and ewes. Failing to realize "war prices" for wool, many farmers conclude that it don't pay, and are inclined to let their flocks slide, so that the drovers and butchers now take the lead in the sheep business. Persistent, systematic farmers are the only exceptions to this rule. Ruinous as this policy is, it fairly exhibits the Yankee characteristic of running on extremes. There is also a disposition to substitute "long wools" for Merinos, and the change is going on constantly.

The show of dairy products, domestic manufactures, fancy articles, fruit and vegetables, was held the second day. There was a fair exhibit of butter and cheese; but of fruit and vegetables the show was meagre. The show of domestic manufactures and fancy work was small; owing to the fact that but part of the day is occupied in the hall,—scarcely time enough to get things arranged—the afternoon being devoted to horse-trotting at the park, a long way from the hall. A Fair building on the grounds would obviate the difficulty; we hope to have one soon.

In compliance with the instructions of the Board of Agriculture, the Society enlarged the premiums on wheat; but with no perceptible effect. The spring was wet and unfavorable for early wheat sowing, and many fields were put in barley and oats that had been laid out for wheat. It proved a mistake, for even late sown wheat yielded a fair crop. Though short, the season was good for corn; but of oats and barley less than an average crop was realized. Beans which are receiving considerable attention as a field crop, yielded abundantly.

The Society is free of debt, with a nice Park and Show grounds, a small balance in the treasury, and is conceded to be working out beneficial results, and giving tone and impetus to agricultural pursuits, within the scope of its influence.

Amount of premiums offered, $398; amount of premiums awarded, $366.

ALBERT MOORE, *Secretary.*

EAST SOMERSET AGRICULTURAL SOCIETY.

SECRETARY'S REPORT.

The Annual Exhibition was held at Hartland, Sept. 8th and 9th. The first day was pleasant and the Show well attended.

The show of neat stock was not large, but the quality very good. We can see quite an improvement in our young stock from year to year. Sheep and swine, few and far between.

The show of horses and colts was very good. There was a fine display of three years old colts. There were four entries of three years old colts, two of the Drew breed and two sired by Gen. Knox. Four better colts we have rarely seen. The Committee were unable to decide which were the best of said colts, and divided the premiums equally between them. H. J. Robinson exhibited his four years old stallion, Drew breed, and was awarded the first premium. He is said to be as fine a colt as can be found in the State.

The show of manufactured articles was small. Dairy products very good. The fruit crop was more than an average. The hay crop good but not well harvested. The grain crop was light; corn about an average crop. The potato crop was good in quality and quantity; it is cultivated largely for market. Root crops good.

Amount of premiums offered, $434.90; amount of premiums awarded, $215.15.

THOMAS FULLER, *Secretary.*

SOMERSET CENTRAL AGRICULTURAL SOCIETY.

Secretary's Report.

The Annual Show and Fair of this Society was to have come off the 23d and 24th of September, but the first day a rain commenced early in the morning, and before noon increased to a driving storm. Quite a number of farmers were upon the ground in good season with their stock, some having driven six to twelve miles. All hopes of a good day being given up, the Society adjourned to the next day, and the stock was either driven home or cared for by members of the Society living near by. The following day was fine and show of stock larger than in former years.

The following entries of stock, &c., were made: Stallions, 10; breeding mares, 12; colts, 27; two town teams, working oxen, 14 pairs; matched and fat, 7 pairs; three years old steers, 40 pairs, besides many two year olds, yearlings and calves; cows and heifers, 40; bulls and bull calves, 25; flocks of sheep, 4; swine and poultry, 3 each.

The day following the Cattle Show being again rainy, the Fair was postponed to Oct. 22d, and if it had been a month later it would have been considered cold for the season. Men shivered in overcoats. But despite the weather the exhibition was highly satisfactory, and demonstrated what might have been on a favorable day.

This Society in 1857 purchased twenty acres of land, fenced it substantially, put up a large building and built a half-mile track second to none in the State. The Society thus found themselves in debt about one thousand dollars, which they saw (or a majority of them) no way of reducing, and finally sold the ground to pay the debt, reserving the right, three days in the fall each year, to hold their Show and Fair. But this was not satisfactory, so the last summer we made a rally and re-purchased the same again, raising the money by subscription, our worthy townsman, Ex Governor Coburn, heading the list with two hundred dollars, and the balance was soon raised, and we are now free from debt.

In conclusion, there is a marked improvement in stock from year to year, due to the introduction of thoroughbreds. There was on

exhibition about 15 head of Durhams, owned by S. W. Coburn, A. B. Chandler, L. R. Bigelow and others, all good animals.

Amount of premiums offered, $565; amount awarded, $410.

JOHN WESTON, *Secretary.*

SAGADAHOC AGRICULTURAL AND HORTICULTURAL SOCIETY.

SECRETARY'S REPORT.

The Sagadahoc Agricultural and Horticultural Society held its Annual Show and Fair upon the Society's ground, in Topsham, Tuesday, Wednesday and Thursday, Oct. 13th, 14th and 15th.

Tuesday was devoted to the examination of neat stock, swine and poultry. The show of neat stock was considered to be the best ever held by the Society. There were not perhaps so many animals on exhibition as at some former shows, but they were of better quality, many of them pure blood, among the most noticeable of which were the short horns of J. Sampson, of Bowdoinham. It is evident that the Society has exerted a very beneficial influence in the improvement of stock within its limits. Much interest is manifested in the improvement of milch cows and many excellent ones were exhibited. Of heifers there were 40 on exhibition, including many promising animals.

The show of horses and colts on Wednesday was highly creditable, much improvement having been made in this department also. Farmers are becoming awake to the fact that it costs no more to rear a good animal than an ordinary one.

The show of vegetables in the Hall, considering the season, was very creditable. Of apples there was a very good display, although the crop in this vicinity is an unusually small one. There were very few pears or grapes exhibited, although there were some very fine specimens.

The ladies, as usual, did their part towards making the occasion interesting, by contributing largely of the products of their industry and the fine display of flowers, which assisted so much towards rendering the Hall attractive.

Thursday forenoon was occupied by the reports of the Committees, interspersed by music by the Brunswick Brass Band. In the afternoon Gov. Chamberlain, by request, repeated his interesting and very instructive address, prepared for and delivered before the Maine State Agricultural Society. There is a good degree of unanimity among our members, and the community generally patronize the Fair.

We think the Society is exerting a beneficial influence, not only in the improvement of stock, but in inducing a better system of agriculture generally. The season has been unfavorable for agricultural productions. The crop of grass was abundant, but on account of frequent rains and long continued dull weather, much of it was injured in curing.

The crops of grain and potatoes was unusually light, yet we have much reason for gratitude to our Heavenly Father for the many blessings he has bestowed upon us.

Our receipts were $1,098.07.

Amount of premiums offered, $805.75; amount awarded, $618.15.

GEORGE A. ROGERS, *Secretary.*

WALDO COUNTY AGRICULTURAL SOCIETY.

SECRETARY'S REPORT.

The Waldo County Agricultural Society held its Annual Exhibition for 1868, on its grounds at Belfast, October 13th, 14th and 15th. The show on the first two days compared favorably with preceding years, and the attendance was good, but the third day was rainy, the attendance small and the receipts consequently very materially diminished. The receipts will just about meet the current expenses.

The Society owns a Park of about twenty-three acres, situated in this city, and valued with its appurtenances at about $3,000. Liabilities of the Society, $1,200. On the Park which is graded and surrounded by a board fence, is a large exhibition hall built last year, two stories high and fitted for an exhibition room below and seats for spectators above. It is thorougly built and finished. There is a fine half mile trotting course on the Park, also stables, judges stand, ticket office, wells of water, &c.

The whole amount of premiums offered this year was $900. Wheat premiums offered, $73; Receipts $1,626. Received from State, $290.47.

The wheat premiums offered caused some competition.

The committee awarded as follows:—First premium to Joel Prescott of Northport, for best acre of wheat, having harvested twenty-six bushels, as given in the accompanying statement.

In 1867 I broke up one acre of green sward and planted it with potatoes manured in the hill. In the fall of '67 I spread fifteen loads of old manure on two-thirds of the ground; in the spring of 1868 I plowed, harrowed and sowed my wheat. The one-third that had no manure on it I sowed twelve bushels of ashes; that did not grow as stout as the part that had the manure spread on. My seed wheat I soaked in strong pickle six weeks. I had twenty-six bushels without the tailings.

JOEL PRESCOTT.

The second, to William N. Hall of Belfast, for second best acre, he having harvested 21¼ bushels.

I submit the following statement of one acre of wheat:

Ploughing ground,	$3.00
Sowing,	2.50
Two bushels seed wheat,	7.50
Harvesting, "	6.00
Threshing, "	4.50
Three cords manure $3 per cord,	9.00
Total,	$32.50
Twenty-one and one-fourth bushels wheat $3 per bushel,	$63.75
Cost of raising,	$32.50
Net gain,	$31.25

WM. N. HALL.

The third, to Franklin Colamore of Lincolnville. He harvested, as per statement, 19½ bushels from one acre.

I herewith present you a sample wheat grown as follows, viz: On the 6th day of June I sowed one bushel and three pecks of wheat on one acre of land; Sept. 9th, I harvested some and hauled it to a mill to have threshed, (I hauled it from the field as I had not barn room,) I had nineteen and one-half bushels. The land on which it was raised was nearly covered with alders a few years

ago. In 1866 I gave it a fair dressing in the hill and planted it to potatoes; in 1867 I again dressed it in the hill and planted it to potatoes; in 1868 I sowed it to wheat, as before stated, and did not apply any dressing. In regard to expense of cultivation I did not keep any exact account but make my estimate according to what labor I must have spent, and will not estimate use of land.

One day self and oxen ploughing,	$3.00
One-half day sowing and harrowing,	1.50
One day reaping,	2.00
One-half day hauling some to have threshed,	1.50
Self, oxen and threshing,	6.00
Two bushels for seed at $3,	6.00
Total,	$19.00
Nineteen and one-half bushels at $3 per bushel,	$58.50
One ton straw,	5.00
	$63.50
Expense in raising, not reckoning use of land,	$19.00
Balance,	$44.50

FRANKLIN COLAMORE.

A. D. CHASE, *Secretary.*

NORTH WALDO AGRICULTURAL SOCIETY.

SECRETARY'S REPORT.

The Annual Fair of the North Waldo Agricultural Society was held at the Trotting Park in Unity, on the 7th and 8th of October, 1868. The display as a whole was not so large or so well attended as last fall. We anticipated a larger attendance and a better display in every department of our exhibition than formerly, and should not have been disappointed had not our Fair been held on the same days as the State Fair. We endeavored to fix the time of our Fair so as not to interfere with the State Exhibition, but its postponement brought us into collision. Consequently some superior stock and articles were on exhibition at Portland, which would otherwise have been exhibited at our Fair. Leading members of our Society, and those who took much interest in its success, were absent at Portland.

The show of working oxen and steers compared favorably with any former exhibition. The town teams from Troy and Unity attracted much attention and admiration, the team from Troy taking the first premium.

Of horses and colts there was a small display, but some fine animals were presented. More interest than formerly is manifested in the improvement of the horse in our Society.

There were some 10 entries of stock and dairy cows. The bulls presented were of the Durham and Devon blood.

The show of sheep quite meagre but of fair quality. Some very good bucks were exhibited. I regret to say our farmers failed to present any swine, and it is the more to be regretted from the fact that many good porkers should and could have been brought in by our members.

The display in the Hall of home-made cloth, rugs, millinery, and other specimens of the handiwork of our farmers' wives and daughters, although rather limited, was pronounced excellent by the Committee in that department.

Our hay crop was very good this season, and generally secured without damage. A good yield of potatoes and large crop, and but little complaint of the rot. Of oats there was a fair crop. The wheat crop was generally a failure.

Amount of premiums offered, $326.75; amount awarded, $240.50.

S. G. Butman, *Secretary.*

WEST WASHINGTON AGRICULTURAL SOCIETY.

Secretary's Report.

The Annual Exhibition of the West Washington Agricultural Society was held at the Society's grounds in Jonesboro', Sept. 30th and Oct. 1st and 2d. The weather was quite favorable and the attendance about as large as at the previous Fair.

The amount and quality of farm produce exhibited was much better than that of last year, and better than that of any former exhibition. In fact it was very good considering the season, as it was quite late in the spring before most farmers in this section could get their crops planted, owing to the continuance of wet weather. The vegetables were very fine indeed.

The entries of horses were more in number than last year, and about the same in quality. There were some very fine colts of the Knox breed shown.

The directors have, the past two exhibitions, paid mileage on neat stock to which no premium was awarded, which had the effect of drawing out a larger number of cattle to the Show this year than ever before, and the Show was decidedly the best ever seen on the fair ground of this Society. There is a growing interest in the improvement and management of stock, which shows itself more and more yearly. There were some very fine oxen on exhibition of the Durham breed. A fine, full blooded bull calf of the Jersey breed was on exhibition, entered by Gilbert Longfellow; also, an Ayrshire bull by Mr. Holway of Machias. There were some fine cows shown on which gratuities were paid, those entering them not complying with the regulations of the Society so as to entitle them to the premiums.

The interest in sheep seems to be on the wane, owing, I suppose, to the low price of wool. It selling now for from thirty to forty cents per pound here which is hardly enough encouragement. There were but few sheep on exhibition.

The show of fruit was not as good as that of last year. Orcharding is not carried on to any extent. The soil and climate seem to be unfavorable. There was a warm contest for the prizes offered on drawing teams, and an unusual degree of interest manifested by all parties concerned, and a surprising exhibition of strength by the teams contesting.

The show of dairy products was not what it ought to be, although the samples shown were good in quality.

The display of fancy articles was a long way short of that of last year, and it was the regret of many visitors at the exhibition that there should be so little interest manifested by the wives and daughters of farmers in filling up the Exhibition Hall with articles of their handiwork.

There were ninety-seven new members added to our already large list this year.

Again we have been favored with an abundant crop of grass, but the season like that of last year was very unfavorable for securing it. A large portion was injured in curing. The feeding season commenced earlier than usual this fall on account of early snows—the first having fallen on the 17th of October, and the last

in the spring on the 8th of May, leaving but a short season between snows.

Potatoes were excellent in quality and the yield heavy with but little rot.

Owing to the continuance of wet weather it was extremely difficult to harvest crops; and corn, beans, peas, barley and other crops were more or less injured in the field in consequence.

Amount of premiums offered, $670; amount of premiums awarded, $462.

James L. Buckman, *Secretary*.

YORK COUNTY AGRICULTURAL SOCIETY.

Secretary's Report.

The Annual Show and Fair was held October 13th, 14th, 15th and 16th, 1868; the Cattle and Horse Show on the Society's enclosed ground in Saco, and the miscellaneous show of fruit, machinery, fancy articles, &c., in the City Hall in Biddeford. The Fair and Show was appointed for the week commencing Oct. 6th, but was postponed one week on learning the postponement of the State Fair to that time.

The show in almost every department was very good—as a whole an improvement on some previous years. The show of oxen, cows, heifers, bulls and steers, and also that of horses and colts, on the ground, was very creditable. To Mr. Joshua L. Lunt, of Kennebunkport, was awarded the premium for best bull, and to Mr. Josiah McIntire the second premium, for a full blooded Ayrshire, two years old. Mr. Simon M. Blake, of Biddeford, also received a premium for a very fine yearling Ayrshire bull, (first premium), and the second premium for yearling to Mr. Ivory Fenderson, of Saco. Mr. Samuel Milliken, of Saco, showed a fine pair of three years old steers, girth 6 feet 9 inches, and was awarded the first premium; and Mr. Daniel McIntire, of Biddeford, was awarded the second premium for a pair of steers 6 feet 6 inches, 3 years old, and also the first premium on two year olds. Mr. Evans Seavey, of Biddeford, was awarded the second premium for a nice pair of two year olds. Mr. Levi Seavey, of Dayton, received the first premium for yearling steers, and Master John Coffin, of Biddeford, the second premium. The steers of Master Coffin attracted much attention at the exhibition on account of their being under perfect control of their owner, they were so well handled.

The best herd of cows was shown by Mr. Elliot Fernald, of Saco. For the premium on best milch cows there was considerable competition, and the statements of the yield of the cows entered in this department showed well the profits of a good cow. To Mr. Ivory Lord, of Saco, was awarded the first premium for the best milch cow. His statement shows a yield of 207 pounds of butter in 141 days, (which, at the market price, adding the worth of the milk after the butter is taken from it, makes a yield of $126,-06 for 141 days) for one cow. The statement of Mr. Lord, I think, contains some suggestions of practical worth to the farmer.

From Mr. Lord's statement:

From my experience and observation in relation to cows, I make the following deductions, viz: That other things being equal, the fattest heifers make the best cows, and that when cows are kept upon poor hay or coarse fodder, it is true economy to pile it up before them plentifully, and not to feel annoyed if they waste a considerable portion of it, thus making up in quantity what is wanting in quality. Their stomachs become distended by so doing, and they are strong and healthy.

We have kept the milk of this cow separate since the 20th of May, and churned the cream separately, and I herewith give a transcript from my wife's record up to October 8th:

Churned	May	25,	5¾ lbs.	Churned	Aug.	1,	11½ lbs.
"	"	30,	5	"	"	8,	11¼
"	June	5,	9½	"	"	15,	10½
"	"	11,	8	"	"	22,	9¾
"	"	17,	10	"	"	27,	4
"	"	22,	9	"	Sept.	4,	11
"	"	23,	2½	"	"	12,	11½
"	"	30,	10	"	"	19,	10
"	July	7,	11¼	"	"	26,	9
"	"	14,	12½	"	Oct.	8,	10
"	"	18,	7	"	"	10,	9½
"	"	23,	8½				
							207 lbs.

The amount of butter made in 141 days is 207 lbs. From the 20th of May to the 20th of June, in addition to a plenty of good hay and pasture, I gave the cow two bushels of meal, and I also gave her one bushel in September, before putting her into a field. The greatest quantity of milk which she gave in any one day was on the 28th day of June, when she gave 16½ quarts. The amount given

for two weeks at this time ranged from 13 to 16½ quarts per day. At present, Oct. 10th, she gives from 8 to 9 quarts per day. I estimate that the average quantity of milk given per day for this 141 days is 10 quarts, and after cream has been removed, 8 quarts per day, which has been estimated by good authority to be worth for feeding swine two cents per quart, amounting in the 141 days to $22.56. The butter at fifty cents per pound is worth $103.50, which added to milk as estimated, makes $126.06, the produce of the cow for 141 days.

To Mr. Charles H. Berry, of Buxton, was awarded the second premium for milch cow. Mr. Berry's statement showed his cow was three years old the 20th of May last. The mother of the cow was of native breed, her father half Devon, and with her was shown her heifer, one year old May 2d, and her calf four months old. The cow gave 13 quarts of strained milk a day, and made for the seven days before the Fair 9½ pounds of butter, without extra feed.

There was a good show of corn, and a very fine display of garden vegetables in the Hall. To Mr. Morgan L. Gerry, of Alfred, was awarded the first premium for the best half acre of corn, and to Mr. John T. Davis, of Biddeford, the second premium. To Mr. Gilman P. Lougee, of Parsonsfield, was awarded the first premium for best trace of corn, and to Mr. Nathaniel Locke, of Biddeford, the second premium.

Mr. John T. Davis, of Biddeford, showed the greatest variety and best specimens of vegetables, and was awarded the first premium, and Mr. Moses E. Varney, of Biddeford, the second premium. Ira C. Doe, Esq., of Saco, received the first premium for best one-half acre of white beans. Mr. Moses H. Hussey, of North Berwick, showed a very fine lot of potatoes, of a variety of kinds, and received the first premium for best bushel. Among Mr. Hussey's assortment was seen the celebrated Early Rose and the Harrison. Mr. Enoch Smith, of Biddeford, showed a 136 pound squash, and Joseph Etchell, of Biddeford, another nearly as large. Mr. John Q. Dennett, of Biddeford, also showed a very fine assortment of potatoes. Mr. Ivory Lord, of Saco, received the premium on experiments on wheat culture.

The display of agricultural implements and machines was very creditable, showing many improvements in farm implements.

The display of Fruit was not so large as in some former years, though there were fine lots of apples, pears and grapes on exhibition. Mr. Elliot Fernald, of Saco, was awarded the first premium

for the best grown and greatest variety of apples, and to Mr. Amasa Ayer, of Biddeford, the second premium, and Mr. Foxwell C. Cutts, of Saco, the third premium. To Mr. S. T. Eaton was awarded the first premium for the best dish of apples, and to Col. Charles Twambley, of Saco, the second premium. To Mr. Edmund Coffin, of Biddeford, was awarded the first premium for the best bushel of autumn apples, Nodheads, and to Mr. Foxwell C. Cutts, of Saco, the second premium, also Nodheads. To Mr. John Hanscom was awarded the first premium for the best bushel winter apples, (Baldwins), and to Mr. Amasa Ayer, of Biddeford, the second premium for a bushel of Baldwins. Col. Charles Twambley exhibited the best grown and greatest variety of pears, and Mr. Nahum Getchell, of Saco, the second best. Col. Twambley also exhibited the best dish of pears. Mr. John S. Murch, of Dayton, showed the greatest variety and best specimens of native grapes, and Mr. Owen B. Chadbourne, of Saco, the best dish of grapes. Mr. Charles S. Webster, of Kennebunk, exhibited the best lot of foreign grapes.

The best collection of flowers was shown by Miss Isa L. Owen, of Saco. Flowers were also contributed by Mrs. Sarah Bickford, and by Mrs. Goodale.

Very fine carriages were exhibited by Mr. Owen B. Chadbourne, of Saco, and also one by Mr. John Townsend, of Biddeford. Some splendid sleighs were shown by the Hanson Brothers, from their manufactory in Biddeford.

The display of goods of domestic manufacture, rugs, fancy articles, &c., was better than at any exhibition of the Society for many years. The numbered articles reached about 500 in the Hall, and of such superior character as made an excellent show, especially in the rug department. The highest premium on rug was awarded to Mrs. M. Smith, of Saco. This was a picture of Washington crossing the Delaware, elegantly worked in worsted, and attracted much attention during the Fair.

Of general matters pertaining to the business of farming in York County for the past season, I would say that take all crops together, the past season was about an average one. Of corn there was a fair but not large crop. Of potatoes, much less than an average crop. Of small grains, less than usual. The apple crop was quite fair in some parts of the county, and light in other parts. The hay crop was good.

Many farmers of York County planted small quantities of the

new sorts of potatoes; the "Early Rose," the "Harrison," the "Goodrich," and the "Early Sebec." The "Early Sebec" has not proved, so far as my knowledge extends, a healthy potato in this county, nor has the yield been good from that seed. But the other sorts named, viz.: the "Early Rose," "Harrison" and "Goodrich," have proved abundant yielders, and quite healthy. From conversation with the farmers at the Fair, and observations in various parts of York County, I am of the opinion that if nothing but those three sorts named had been planted in York County this past season, that there would have been twice the number of bushels raised that the old sorts have yielded. Mr. Goodale, (Secretary of the State Board of Agriculture), raised the Early Goodrich on a piece of greensward turned over in the spring, and manured only with the Cumberland Bone Co.'s Superphosphate, which yielded at the rate of three hundred and twelve bushels per acre. He deems it a productive and profitable variety, but in quality it did not meet his expectation.

This Society now stands free from debt, with a small amount of funds ahead, the long-standing debt of the Society having been wiped out last year.

The whole amount of receipts of the Society for the year are $1,191.29. The whole amount of premiums offered for the year, $835.00. Amount of premiums awarded, $719.25. Whole amount of disbursements of the Society for the year, $1,069.00.

JOHN HANSCOM, *Secretary.*

KENNEBEC COUNTY AGRICULTURAL SOCIETY.

Secretary's Report.

Our Society is in a flourishing condition. We have not accomplished all we might, had we improved all the means at our command. Many have done nobly. There are those, however, who wish to see two dollars coming for one, before they will take one step aside from the routine of daily toil on the farm which their fathers pursued in days long since gone by. If any new invention is presented to lessen the labor, it must be tried by neighbor A. or B. before they are willing to let go the strong grip they have on the dollar. It is equally so on all and every new thing, whether it be new methods of cultivation, or new seeds, or whatever it may be. It must be proved to be useful at some body's else expense. And should there be a failure—then they are ready to give the knowing shake of the head and that quaint old phrase, which some have used so much that they are ready to avow that it is in the Bible—*I told you so.* I do not pretend to say that we have more than our share of this class of croakers, yet, I do say we have some and they are a curse to any community.

I said we are flourishing and it is so. There has been no entire failure of any crop on the various farms within our limits.

The season for planting was somewhat belated by heavy falls of rain at the time most farmers were about putting in the larger proportion of their seed. Some who were quite smart, and were taking, "as they say," time by the forelock, were obliged to replant their potatoes, with the loss of the first seed. Some fields of grain were badly washed and in places small patches totally destroyed. Planting being delayed, hoeing and haying came very near together. Yet, with the hoeing machine, the mowing machine and the various other machines for helping the work on the farm, including the machinery for helping the good housewife, a great amount of work was accomplished in a very short time. The result of which has been to bring thrift, contentment and necessarily happiness to a large proportion of our farmers.

The time of our exhibition and Fair was a little earlier than usual on account of the State Fair being announced to occur at

the time we usually had held ours. We are of the opinion that all our town shows should be held before our county, and our county before the State. Thus enabling the farmer to select the *best* from the town for the county and the *best* from the county for the State Show and Fair.

Our premium list was larger than ever before, fully complying with the requirements of the State Board of Agriculture in offering premiums on wheat, which we think has had a beneficial effect and hope it may be continued.

The entries of competitors were very good. The first day of exhibition was rather unfavorable, being somewhat rainy; but the next was fair and beautiful. The people came in crowds, thus giving us good receipts wherewith to meet our expenses. Most of our premiums were taken and many gratuities awarded. Our dairy products still taking the lead and far surpassing those at the State Fair.

For the year to come we are to offer more premiums and greater inducements for all to interest themselves in our Society, and we expect a better Show and Fair next fall than we have ever had.

Much interest has been manifested in our Annual Address; always being listened to with fixed attention by a large audience, as is also the music which is usually vocal. As we look over the records for the last half century we find the names of many able and eloquent men that have addressed the Society, and we hope to have one of Maine's most distinguished sons to entertain us at our next anniversary.

Our Society was chartered by the Legislature of Massachusetts February 21st, 1818.

Organized July 4th, 1818 as the Winthrop Agricultural Society —since which time the organization has been continued.

DAVID CARGILL, *Secretary.*

SECOND REPORT OF FISH COMMISSIONERS.

To the Governor and Council:

We, the undersigned, have the honor to present herewith a report of our investigations during the past year, in accordance with a resolve of the Legislature of 1867, entitled "Resolve relative to the restoration of sea fish," and a Resolve of the Legislature of 1868, continuing the same in force.

Our work for this year has been for the most part supplementary to that of 1867. We have substantially completed the survey of the rivers, with the exception of the St. John waters, sufficiently to enable us to state the condition and needs of each river visited. The work of building fishways has been commenced by the erection of several on the East Machias and Denny's rivers, and the location and ordering of several on the St. Croix. We are unable to proceed as we wished to the work of opening the Kennebec and Penobscot, by a fault in the language of an act to give us general anthority in the matter, passed last winter. Nevertheless, we think the money at our command has been well expended in continuing the work of examination left incomplete last winter, in a careful personal examination of the modes employed in taking migratory fishes, and in experiments on the reproduction of several species.

With these preliminary remarks, we will proceed to lay before you the results of our examination of each river visited, commencing at the eastern boundary of the State; and will then present such suggestions as may occur.

St. Croix.

This river was visited, the dams at Calais, Milltown and Baring a second time examined, and sites selected for fishways. The proprietors were consulted, and agreed to build the fishways according to plans that were drawn and left in the hands of Mr. Seth Emerson, who was engaged to superintend their erection.

Yet we regret to say that for some reason unexplained, the season was allowed to pass and no fishways were built.

The law forbidding fishing within half a mile of the lower dam has been openly violated, under the plea that its observance was not to be expected while there were no fishways.

Salmon are thought to be increasing slightly in this river. A few of them reached Milltown this year. With good facilities for ascending to the fine spawning grounds that lie all along the main river and on many of its branches, they would in a few years become tolerably plenty. The whole cost of opening fishways would, we think, not exceed $3,000. There are many driving dams on the upper tributaries, but they are not generally prejudicial to the salmon, and scarcely any expense would be required to avoid obstructing them altogether. The greatest danger is that they might be used by poachers to take fish illegally.

Denny's.

Salmon and alewives are still steadily increasing in this river, and we have no doubt that they will regain something of their ancient numbers. The dam at Dennysville of B. & E. Lincoln, which has been a serious hindrance to the increase of the fish, has this year been provided with a good fishway in accordance with the directions of the Commissioners.

East Machias.

The fishways on this river being in an unsatisfactory condition, the owners of dams were directed to place them in proper repair, and to make certain alterations deemed necessary. The proprietors agreed to make the required alterations and repairs, but from some cause failed to do so during the past season, with the exception of P. S. J. Talbot & Co., who constructed a new fishway through their dam at Jacksonville. It is presumed that another season will see all the other dams in East Machias provided with better ways than now.

Besides the dams above referred to, there are four upon the upper part of the river which we examined this year. They are as follows:

1st. Monson Rippling's dam, commonly closed during the first run of fish.

2d. Long lake driving dam.

3d. The Barstow dam, so called, in the town of Crawford.

4th. The dam at the outlet of Crawford lake.

None of these are provided with fishways, and all are obstructions to the ascent of fish.

This year there was a marked increase in the number of salmon in the river.

Wescongus.

Salmon continue to come to the falls at Columbia, but are unable to pass the dam at that place. A few have been carried by and put into the river above; but for any important increase, a good fishway and a stringent law are required. The present fishway was built so far from the main channel, in order to secure it from freshets, that salmon will not take it. One to succeed must be built under Mr. Harris' mill.

Narraguagus.

The people at Cherryfield are much interested in the restoration of fish to their waters; and at the request of Messrs. Campbell, the principal mill owners at Cherryfield, the dams, five in number, were examined. They average ten feet in height, and present no special obstacles to the construction of fishways. It is hoped that the Commissioners will, at an early day, be able to direct the construction of suitable fishways. It is but a few years since this river produced salmon, shad and alewives in abundance.

Union.

All the dams in Ellsworth were examined. There are none that present unusual obstacles; the average height is ten feet.

The fishery on this river was formerly excellent, producing salmon, shad and alewives; but it has shared the common fate, and these species are now nearly extinct here. The expense of constructing fishways and restocking the river would be comparatively small.

In a tributary that drains Reed's pond there is a fishery for "land-locked" salmon, which species was once abundant but is now scarce through reckless fishing. A strict enforcement of a stringent law is needed to protect them, but the general law protecting trout and salmon at the spawning season is sufficient if well enforced. It was from a tributary of this river that the fish was obtained which Girard has described as *Salmo Gloveri*, but this

name has by subsequent writers been applied to the fish found in Grand lake and other parts of the St. Croix waters, without, so far as we know, ascertaining the identity of this fish with that described by Girard.

Penobscot.

The time that we were able to give to the Penobscot this year was mostly occupied in a tour through the fishing district, during the month of May. The weirs were then in full operation and much valuable information was elicited.

In old times the most abundant fish (in bulk) in this river was the shad; this was probably the most valuable. Next came the salmon. Alewives were exceedingly abundant but little esteemed. Bass, (*Roccus lineatus*, Gill.) were not rare. At Oldtown falls as many shad and alewives were taken as would supply the demand, and many fold more might have been taken; the price, one dollar per hundred for shad, was not sufficient inducement to provide beforehand the necessary barrels and salt to take care of them. On the lower part of the river the market was more convenient, many vessels, mostly from Connecticut, coming every season to load with shad and salmon. Immense quantities of them were shipped in this way. Before the river was closed with dams the price of salmon had risen to six cents a pound, that of shad to six cents apiece. Alewives, smoked hard for the West India market, brought in early times thirty-three cents a hundred in Boston, and the price afterwards rose to one dollar and one dollar and a quarter, when they were very profitable. The fishing, previous to 1785, was all done with nets, but they have been gradually superseded by weirs and at the present time very few nets are used. Their use, however, was continued as long as it was profitable. At one time there were, it is estimated, two hundred men employed in drifting between Mill creek and Olamon's ledge. In 1811 a Mr. Emerson of Phippsburg, came to the Penobscot with what he claimed to be a patent weir, and it was a great improvement over the half-tide brush weirs then in use. The latter consisted of a single enclosure of brush, left bare at low water, and covered with six feet depth at high water; the fish simply swam in over the top of the enclosure and were left by the receding tide. Such weirs are still used to advantage in particular sites and for certain purposes—for instance in the winter fishery for smelt on the Kennebec. But in the ordinary summer fishery the weir introduced by Emer-

son was far more effective; it had three pounds and was built to the top of the tide with an entrance for fish as in those described in the last Report of the Commission. Further improvement was introduced by one Holliday from St. John, N. B., who substituted marline for brush on part of the pounds. The quantities taken by these new inventions were enormous. Emerson's first weir, built on Treat's Flats, was, it is said, quite burst open by a quantity of fish that it could not hold.

During all these early years the fish found extensive breeding grounds above the occupied portion of the Penobscot valley. Though shut out from some of its tributaries, a circumstance alone sufficient to effect, in time, a decrease in their numbers, the great highway to the many lakes and streams in the wild lands remained open until about the year 1830. It was then nearly closed by Fiske and Bridge's dam at Oldtown Falls, in which there was and is still a passage by which some salmon pass every year; and in favorable seasons shad and alewives pass up in limited numbers. After this the Great Works dam was built, and in 1834 or 1835 the Veazie dam. The latter was closed in the winter. When the fish came in the spring they found an impassable barrier across their way; they gathered in multitudes below the dam and strove in vain to surmount it; many returned down the river, and after the usual time for the spawning of shad was past they were taken in weirs in the town of Bucksport, loaded with ripe spawn which they could no longer contain; a phenomenon which Mr. John C. Homer who has fished with weirs at that point for forty-three years had never observed at any other time. These were doubtless shad whose natural spawning grounds lay far up the river, and who had after long contention given up the attempt to pass the Veazie dam. A great many shad and alewives lingered about the dam and died there, until the air was loaded with the stench.

For a few years after the construction of these dams, fish were abundant; then a rapid decline set in, and in a few years more they were comparatively scarce. In the case of salmon, they reached their lowest point ten years ago, since which time there has been a considerable increase, which may be owing to some increased facilities for passing the dams. We know that the water has made a way for itself around the end of Veazie dam, where water enough flows to enable salmon to surmount it, so that at the present time, as stated in our last report, salmon, the most vigorous ones, that come at the right season, and do not get

caught in the traps set on the falls, can reach the head waters of some of the upper branches. But the decrease of shad has never ceased. They are growing constantly less, and instead of exporting shad by the cargo, the people of the Penobscot valley are forced to import from other rivers shad for their own consumption. From some erroneous information received by us last year, we were led to estimate the yield of shad in the Penobscot at a figure which appears, in the light of the facts elicited by us this year, to be exceedingly extravagant. We supposed it probable that the Penobscot produced several times more shad than the Kennebec, whereas our present estimates say that it yields not one twentieth part as many. At first view this is a most singular fact—that two rivers running side by side, of nearly equal size and of very similar character, and originally producing the same kinds of fish in nearly the same proportion, should now yield, the one less shad than salmon, the other two hundred fold more—as in the table—

	Salmon.	*Shad.*
Penobscot yields,	8,000	5,000
Kennebec,	1,000	225,000

If we next consider the state of the dams across the two rivers, and the facilities that fish have for passing them, the yield of shad appears still more remarkable; for in the Kennebec they do not pass the very first dam, that at Augusta, while we know that they do sometimes succeed in surmounting all the dams on the Penobscot, and it is stated that it is no uncommon thing to find young shad wrecked on the Oldtown falls on their way down to the sea. We think that the true explanation of the phenomenon is found in certain natural features of the two rivers which we have not yet noticed. In the Kennebec the shad breed all the way above the outlet of Merrymeeting bay as far as Augusta, and in the various tributaries that enter Merrymeeting bay, including the Androscoggin as far as Brunswick. Close and practical observers of their habits consider Merrymeeting bay as a most favorable ground for the breeding of shad, and the main stay of the Kennebec river. Its broad, sandy flats, bared by each ebb to the rays of a summer sun, and giving back its heat to each incoming flood of fresh water, have wonderful influence in hastening the maturity of the breeding fish that seek the shallows. All the tributaries of this bay, the Kennebec, Eastern river, Abagadassett, Cathance, Androscoggin, afford many miles of warm waters flowing back

and forth with the tide, very favorable to the development of the embryo fish. The saltness of the sea is rarely or never perceptible in these waters, until after the spawning of shad; and in the middle of a dry season we think it is not perceptible farther than Richmond. Ripe shad are at the proper season found in all waters of the bay and its tributaries. The Penobscot has no such expanse as Merrymeeting bay, nor such tidal tributaries as have the Kennebec and Androscoggin. Its waters, seldom fresh at Bucksport, are in a dry season brackish all the way to Bangor. Its natural breeding grounds lie farther up the river. Ripe shad have never been found in Bucksport but once, as above stated. Now these differences are sufficient to cause a great disparity between the two rivers, much too great to be counterbalanced by the offspring of the few shad that pass the dams on the Penobscot; but does it account for all? It would seem that there should still be fresh water enough below Veazie to breed more shad than the small catch of five thousand would indicate. There is certainly one other possible cause—namely, the sawdust. We know as yet too little about the conditions essential to the development of the young shad to say confidently whether the parent fish will deposit her spawn, and the young hatch, on a bed of sawdust. If not, no young shad can be produced below the lumber mills. It is, however, tolerably certain that all life is destroyed on the bottom where a body of sawdust settles. There are no more of the insects and other minute creatures that thickly people all stony and gravelly bottoms, and on nearly all natural bottoms afford abundance of food to young fish. Young shad must eat, and if born on a barren sawdust bottom must get into other waters quickly or starve. We must not, however, be too confident in this matter, for we do not know to what extent they are dependent on the bottom for food, or how far the barrenness of the bottom deprives the water above of nourishing food. Compared with the Penobscot, the Kennebec is tolerably free from sawdust.

The fishing is at the present day almost entirely confined to weirs. Set nets do not pay, nor do drift nets except near the falls. Mr. Simeon B. Rich, of Bucksport, fished with a drift net thirty and forty years ago, and would get sometimes three hundred shad in a single night; in 1867 he tried it again, but caught no more than three shad in any one night,—sometimes two, one or none. The weirs are mostly built below Bucksport, extending along the east shore of the bay as far as Castine and along the west shore as

far as Camden. We have a tolerably accurate list of those on the east shore, and on the west shore as far as Sandy Point (or "Fort Point,") in Stockton. Between the latter point and Belfast nineteen can be counted from the deck of a steamer. Below Belfast we can merely estimate them. The following will be found nearly correct:

	No. of weirs.
Between Bangor and Bucksport, both sides,	24
" Bucksport and Eastern R.,	5
" Eastern R. and Orland shore, about	24
In Penobscot and Castine,	31
In Verona,	32
West shore from Fort Knox to Sandy point,	27
From Sandy point to Belfast, about	20
" Belfast to Camden, about	20
Total,	183

One of these is merely a hedge with a gill net set at the end of it; one is a half-tide weir; thirteen or fourteen others (in Eastern river) are shoal weirs, built only to low water mark. The remainder are all deep weirs, built into from eight to twenty-five feet depth at low water. The stakes for many of them have to be forty feet long. The construction of these deep weirs is totally different from that of the deep water weirs used on the Kennebec, described and figured in the last report. All of the Penobscot weirs, whether built in shoal or deep water, are essentially on the same plan. That enclosure in which the fish are taken is floored in all cases with boards, and corresponds with the last part of the "pocket" of the Kennebec shoal weir; and no matter to what depth of water the weirs are built, this floor is always sufficiently high to leave the fish bare or nearly so at low water. They generally consist of three pounds, one large and two small ones, the latter being both floored. The cost of a new weir is about eighty dollars, ($80), but as the netting lasts about three years and the stakes five or six, the average annual cost per weir may be put at sixty dollars, ($60). Total annual expense of building 183 weirs, $10,980. In the river the weirs are built as soon as possible in the spring, for salmon are then running; they have even been caught at Oldtown before the ice is out of the river below. On the other hand the weir at the entrance to Castine harbor is not built until May tenth to twentieth, because no salmon can be caught earlier; in 1867 it was finished

about the eighth, and not a salmon was caught until the twenty-ninth. Along the shore from Castine to Orland the weirs are stripped about the middle of August, a few salmon coming up to that date, and we suppose the same to be the case with other parts of the bay, although the Verona people say that the fishing season is substantially closed by the middle of July, and probably the weirs are not maintained so long in the river as below. The law regulating the fisheries of this river, which prescribes that the weirs shall be stripped July fifteenth, does not apply below Verona.

We have collected a mass of information about the yield of the various fish caught, from which we will draw a few general statements. The yield of salmon is better in the bay than in the river. The most productive weir of which we have any information is that at the entrance of Castine harbor, which produced in 1867 more than 1600 pounds of salmon. Along the shore from Castine to Orland the average catch is set at fifty per weir; best catch in 1867, ninety-five in one weir. In Verona the best weirs yielded about one hundred each; average fifty or more. Above Bucksport the average is about thirty. It is supposed that the weirs on the west side of the bay are as productive as those on the east side. Assuming the general average to be forty salmon per weir, the total catch of 183 weirs appears to be 7,320 salmon, and the number caught by other means may make up the number to 8,000. Numerous statements agree that the yield is not more than half what it was twenty-five years ago, but that it is decidedly better than in 1860. Yet the people above Bucksport have not perceived this recent increase, but have found their salmon growing fewer and fewer.

The catch of shad was in some places reported equal to that of salmon, in others as much less. Alewives are principally caught on the east side of the bay, and in Eastern river and thoroughfare. They are supposed by some close observers to breed only in the ponds on Eastern river; we certainly know of no other breeding ground open to them, unless a few can surmount the dams or find some suitable spot below them, on the main river.

In the records of the town of Orrington are found some statistics which enable us to compare the present yield with that of the few years preceding the building of dams. We extract the following items:

For ten years previous to 1836. Year.	Sales.	For ten years subsequent to 1840. Year.	Sales.	For ten years previous to 1869 Year.	Sales.
1826,	$359 00	1841,	$42 70	1856,	$31 28
1827,	410 50	1842,	54 85	1858,	7 00
1828,	492 00	1843,	22 25	1860,	1 00
1829,	440 60	1844,	7 69	1861,	2 65
1830,	445 60	1845,	2 47	1862,	4 50
1831,	530 75	1846,	9 61	1863,	4 50
1832,	481 00	1847,	6 30	1865,	18 00
1833,	171 25	1848,	33 15	1866,	21 25
1834,	40 70	1849,	32 72	1867,	9 50
1835,	144 83	1850,	4 04	1868,	26 50
Total,	3,516 23		215 78		126 18
Average,	351 62		21 58		12 62

The river was completely closed by the Veazie dam in 1835 or about that, and by 1840 had accomplished its work of destruction, and we observe that from 1840 to 1850 the sales averaged only one sixteenth (1-16) as much as before 1836. Of late the yield has been even less, and in 1857, 1859 and 1864 no sale was effected; for the last ten years when a sale was made the average amount received was only $12.62, or about one twenty-eighth (1-28) of the receipts previous to 1836. Now, then, we suppose that this record of Orrington is a fair representation of the decline in the fisheries on the whole river; and had there been no change in the price of fish since the first decade we could ascertain very closely the amount of fish that the same instruments of capture now used would have taken at that time, by multiplying the present ascertained yield by twenty-eight (28). Thus the 183 weirs now built are estimated above to have taken 7,320 salmon in 1867, and it will certainly be safe to put their catch at 5,000 annually for the last decade. Multiplying this number by 28, we find that these 183 weirs would, on the supposition of no change in prices, have taken 140,000 salmon in one year previous to 1836. And after taking into consideration the appreciation in prices which hinders the Orrington records from showing the full decline of the fisheries, and the great number of drift nets and set nets that were once at work and have now been abandoned, we can confidently say that the average annual yield of the Penobscot before its obstruction by dams, could not have been less than the equivalent of 150,000 salmon and 150,000 shad. As shad were

then far more abundant than salmon, we may raise the estimate for them to 2,000,000, and lessen the estimate for salmon to 100,000 annually. Their value at present prices would not be far from *half a million of dollars.*

One fact of particular interest was established by the testimony of all with whom we conversed on the subject. In many cases two weirs are built on the same hedge, one at its middle and one at its outer end. The inner weir invariably catches the most fish—twice as many salmon and three times as many shad and alewives. This shows us the course taken by these migratory fishes. Instead of following the centre of the channel they follow its banks, and at high water spread out over the flats. The experience of drifters is to the same effect. They meet with the best success when they follow the banks of a broad channel rather than its centre. The fish are all coasters, and when first found approaching the rivers, while yet perhaps far from their mouths, they are sedulously feeling their way along the shore.

With regard to the laws regulating the fishery, they do not appear to be regarded on this river. The act of the last Legislature prohibiting the fishing within a half mile of the lower falls has been openly and continuously violated, and we are informed that the Bangor market has been principally supplied, and some shipped to Boston from drift nets on the forbidden ground. A trap has been set on the falls and taken many salmon. Evidently there is fault somewhere. We are of opinion that greater responsibility should be put upon the wardens, and that a larger number is needed on such a river as the Penobscot. The law, having been amended by abolishing the office of fish warden for Waldo county, now provides for only two wardens, one to reside in Penobscot county and one in Hancock, and at the present time there is a vacancy in Hancock county. It is idle to expect one man, however well meaning, to guard the whole Penobscot river.

A projected exploration of the upper waters of the Penobscot fell through in consequence of the ill health of the Senior Commissioner. We are, however, able to state on good authority, that there is a dam at North Twin lake, sixteen feet high, which needs a fishway. There is another dam at the outlet of Chesuncook lake.

The state of the various obstructions on the river remains the same as last year. We deemed it inexpedient to move in the matter, since it was thought that the act of the last Legislature, intended to give us power in such cases, did not apply to the Penobscot,

and that the authority to build fishways or order their construction still remained in the hands of the wardens.

Eastern river, Orland. This branch of the Penobscot was the second time visited this year on the first of June. The people of Orland are anxious about the constant decrease of the alewives, and desire to have some effective measures taken to secure an increase. The general opinion is that the imperfect means of passing the dams are mainly to blame for the decline of the fish. At the lower dam the water falls three feet and a half below the floor of the lock through which they pass, so that fish cannot get into the lock at low water, but collect at the dam. Before the present stone dam was built they used to be dipped in large quantities in a pool, but now there is no good place to dip and few are taken at these falls. A man is paid ten dollars per season to lock the alewives through. It is done in this way: the lower gates are opened and the water started through the upper gates sufficient to attract the alewives; when they are seen to have entered the lock in sufficient numbers the lower gates are closed and the upper opened, so that the fish may pass out; but they sometimes refuse to leave the lock, if it is near night when the gates are opened, and are liable to be stolen out by poachers before morning. We deem it of great importance that the alewives should be able to enter the passage way and pass the dam at whatever time they may arrive at the barrier, and this cannot be accomplished by the lock. When boats and lumber are passing the fish are disregarded, and near low water it is impossible for them to enter the lock. A fishway built on the east side of the river, away from the bustle and noise which must frequently disturb them at the lock, and being open and passable at all stages of the tide, would be much better than the lock, however faithfully this may be tended.

The same reasons will not fully apply to the upper falls, but there, too, we have no doubt that a fishway will be much better than the lock. It is complained that the fishing at this point is reckless, and without regard to the law—that the fish are taken under the saw-mill, where they are tolled by the greater flow of water, and are often stolen out of the lock.

At the time of our last visit the wardens were endeavoring to restrict certain of the weirs in the tide water which had been built beyond the limits fixed by the special law regulating this river. The legal limit is low water mark. In the three miles of tide water over which the wardens consider their jurisdiction as extending

are twelve or fourteen weirs, and a slight extension into the channel would prove very detrimental to the fish. It is even doubtful whether they will not prove too effective even with the legal limit strictly observed. There is some complaint about their obstructing navigation, but this might be obviated by a proper construction of the hedges, so that they would not present serious opposition to the momentum of a schooner under way;—this is already done to a certain extent.

The amount of fish taken by the weirs is very considerable. They average 30,000 alewives apiece, those fourteen within the jurisdiction of the special law probably yielding 400,000 annually. Great numbers of alewives are taken along the shore toward Castine, in Verona and in Eastern thoroughfare, a large part of which must breed in this river. 400,000 may safely be added from this source. Of those taken at the upper falls in Orland we cannot speak confidently, but some believe as many are caught there as in the fourteen weirs. But if we add 200,000 for the falls, the total annual produce of these breeding grounds appears to be 1,000,000 alewives.

It might be necessary to forbid entirely the fishing at the upper falls. At any rate fishing about the locks or fishways should be carefully avoided. The license system which we shall in this report recommend would enable the officers of fisheries to restrict the number of nets and other implements used as far as they should deem necessary; but the most essential thing is a good fishway over each dam, carefully protected from all encroachment.

St. George.

Alewives are the only fish of importance caught in this river now. They are mainly taken at Warren. This town has had the management of the fisheries within its limits since 1802. Their practice is to employ an agent with deputies to take the fish. Tickets are issued to heads of families, each ticket entitling the holder to three hundred alewives. Sixty cents is charged for each ticket, and their order of precedence is determined by lot. Certain poor are supplied gratis. All the tickets being supplied, the remainder are sold for the town to any buyer. From these sales large sums were formerly realized. The highest sum obtained was $2,300, which paid the town tax for that year, the minister's salary, and left something over. The sales for the last twenty years have been as follows:

Year.	Sales.	Year.	Sales.
1849,	$206 00	1859,	$340
1850,	144 25	1860,	471
1851,	565 90	1861,	150
1852,	826 77	1862,	229
1853,	473 00	1863,	190
1854,	1,146 16	1864,	65
1855,	591 00	1865,	no sale
1856,	420 00	1866,	176
1857,	355 00	1867,	138
1858,	382 00		

The causes of the decline are overfishing on the lower part of river and imperfect fishways. There are six weirs built below Thomaston and one above. Many persons in Warren and Cushing fish with long set nets, and take large quantities of fish. One man took 30,000 before the tenth of May. All these engines are illegal. The nets are, however, permitted until the tenth of May, when the Committee notify all persons to cease their use. Yet they are still used in defiance of the law. The Committee has no authority beyond the town of Warren; and until the amendments of last session the wording of the law was such that it was difficult for them to enforce its true intent.

There are two dams in Warren, and they are both provided with fishways, but the upper end is in each case too difficult, the water forcing through under a head of several feet, and being too violent for alewives to stem readily. The fishway should be carried up further until its head can be constructed as recommended in the report of last year. The same cause hinders the young fish in their descent; if no water is flowing over the dam they cannot find the head of the fishway, and at the upper dam run down a long canal and into its only outlet, a covered flume leading to the wheel of a powder mill, which destroys a great many of them.

It is generally observed that the young alewives, on their journey to the sea, swim near the surface, and if the upper entrance to the fishway were open, and a coarse wooden grating placed obliquely across the head of the canal, the greater part of them would doubtless go down the fishway. The approach to the foot of the lower fishway is through too shoal water. There should be a deep pool at the foot. Its location is not the best; it should be on the west side of the river. Where it is now the fish are con-

stantly disturbed and driven back by the passing of persons to and from one of the fishing stands.

The essential needs of the Warren fishery are then a curtailment of the amount of fishing, by restricting the nets and weirs, perhaps a positive prohibition of the nets, and improvements in the fishways which we have indicated. If managed under the general law which we shall propose, there would be sufficient power in the officers of fisheries to effect all these desirable reforms, but if the town is to continue to manage the fisheries under a special law, jurisdiction should be given to the officers on the whole river.

Pemaquid.

The town of Bristol by authority of an act of March 4, 1826, has had the management of the fisheries on all streams within its limits. The principal stream in Pemaquid river, which drains several ponds lying in Bristol and adjoining towns, having an area of two thousand acres or more, and is by nature a most excellent alewife stream. In old times it furnished large quantities of food to the inhabitants of several towns. Until 1830 everything went on smoothly. The owners of the dams were ready to do their part by providing passage-ways for the alewives and keeping them in good order, that the people might have plenty of fish. The latter were abundant, and were really a blessing to the people who shared them. But about 1830 Jas. Drummond, proprietor at Bristol Mills, sold his mill and dam; the upper dam at the same village was afterwards built, and in 1839 the lower falls also changed hands. The new proprietors seem to have lacked the generous public spirit that distinguished the old ones; and were quite ready to sacrifice a great public good to private convenience. Henceforward there was a continual struggle between the fish committee and the mill owners; the former striving to obtain the right of way which belonged to the fish, and the latter studying "how not to do it." The upper dam, known as the "Bearce" dam, was very formidable and its owners succeeded in managing it in such a way that it was rarely passable by alewives. The other dams, except that now owned by Mr. Hatch, were managed, it is alleged, against the fish. We presume, too, that there was some over-fishing. Mid all these difficulties the fish declined and the people were dissatisfied. In striving to protect the fish against poachers and to secure a passage for them to their spawning grounds, the town became involved in expensive law suits, in which it generally, and

we think always, lost. There are charges of incompetence and mismanagement against various officers connected with these suits, but we had not time to sift the matter, nor was it deemed necessary. The most expensive of these suits arose in consequence of the fish committee cutting away the Bearce dam because the owner would not provide a fishway. This case was carried up to the supreme court, and we learn, from the report (Bearce *vs.* Fossett, 34 Me. 575), that the case was decided against the town because the constable who posted the notice of the town meeting where the fish committee that cut away the dam was chosen, omitted the words "and conspicuous" in his return, stating that he had posted the notice "in three public places," instead of "three public and conspicuous places." This informality was the sole ground of the decision, and would have been equally effectual to invalidate any and all of the acts of all the town officers elected at that meeting. Nevertheless it was used with effect to throw odium on the alewife fishery, and its cost was sufficient to swell the amount of expense to far beyond the actual receipts of the fishery.

A statement has been drawn up from the records of the town by Mr. C. C. Robbins, showing the income and outsets of the alewife fishery for forty years; from which it appears that the total income during that time was $1,626, and the outsets $4,031.22. Certain items of interest are improperly included in this statement, and without them the amount of the outsets is $3,730.20. Of this sum $3,218.20 was expended in law suits, showing the normal expenses of the fishery for forty years to be $512, and the receipts $1,626. The whole extra sum of $3,218.20 is the cost to the town of having selfish mill owners, greedy poachers and incompetent officers. But on the other hand, it must not be supposed that the sum of $1,626 represents the entire value to the town of the fishery, for it was never managed as a source of revenue, but to furnish cheap food to the citizens.

In consequence of these various troubles the people of Bristol have become tired of managing the fishery, and a petition signed by a large majority of the voters was presented to the last Legislature, praying that all laws relating to the subject be repealed. This petition was considered by the Committee on Fisheries, and referred to the next Legislature, with the understanding that meantime we should visit Bristol and examine the matter. We have performed that duty, and have elicited the facts stated above.

In conclusion, we have to say that the natural advantages of the

Pemaquid river are superior and it ought to yield a large amount of food yearly; but that through the selfishness and greed of a few individuals and general mismanagement, it has become an expensive luxury. The town of Bristol will not be likely, in its present temper, and with the influences that now sway its councils, to manage the fishery either successfully or wisely, and we advise that it be relieved of the charge by repealing the act of March 4, 1826.

DAMARISCOTTA.

We visited this river during the alewife fishery. No other kind of summer fish are taken here in considerable numbers. The only breeding ground for alewives is in Damariscotta pond, a sheet of water about ten miles long and containing perhaps six or seven thousand acres. So near to the sea, it is admirably fitted for the production of those fish. Its waters fall directly into salt water. But naturally it was quite impossible for fish to ascend to the pond. The fall is fifty feet in height, over a rugged ledge. The flow of fresh water always attracted a few straggling alewives; but no large number of them ever came to this stream; a man must dip for several hours to get a mess of them. The inhabitants obtained their supply from Pemaquid and Warren, where alewives were then abundant. But about the year 1803 the idea was conceived of putting some of the fish over the falls into Damariscotta pond. This was done by Daniel Waters, James Kavanagh, David Clark, Jeremiah Russell and some others. In about three years an increase was observed, and instead of carrying the fish up by hand, it was thought best to build them a fishway, (fish-stairs the structure might well be called.) This was done by constructing a long series of small pools of loose stones laid on the ledge in a small channel that ran near the east bank of the stream. We should say there might be twenty or thirty of these pools, and the water pours from one to the other, following a long, crooked route to the tide below. The alewives came, and searching for a passage found this artificial way and followed it to the pond above. They now increased wonderfully, and although not now so plenty as once, they yield as many at this one point as are taken by the eighty-six weirs built on the Kennebec.

In 1810 the towns of Nobleborough and Newcastle obtained an act from the Legislature and assumed the control of this fishery. For the last three years it has been sold at public auction, the fish

committee (usually the selectmen) first fixing the price at which the purchaser shall sell fish fresh to all applicants. Fifty cents a hundred has lately been the price. The auction sale brought in 1866, $1,080; in 1867, $1,450; in 1868, $1,505.

The management of this fishery by the two towns appears to be eminently satisfactory, and we think it should be continued in their hands. Some complaint is made that the weirs on the lower part of the Damariscotta river are interfering with the cultivation of the alewives, and many citizens regard the alewives as the exclusive property of their towns, and object to the residents on the lower part of the river being allowed to take any of them. It would certainly seem that a community that has succeeded in producing, by by their persistent efforts, such a supply of food where was original sterility, should have the fruits of their toil and care secured to them. That such has been the history of this fishery has been disputed, but we have taken pains to search into the matter, and are satisfied that the fishery was created as related above. Amongst other persons who are acquainted with the facts, Mr. David Clark is still living; and Mr. Wm. Hunter, of Bristol, ninety-one years of age, but of remarkably tenacious memory, has fully confirmed the story of Mr. Clark. On the other hand the owners of weirs state that they have long been accustomed to build them, never heard of the early cultivation of the fish by the people at the mills, and that the matter has been only recently agitated; and that the alewives they catch are but few and cannot interfere seriously with the profits of the Newcastle and Nobleborough people. Disinterested parties estimate the total number taken by the weirs at not more than two hundred thousand yearly, and we think that is not far from right. That would make a difference to the towns at the falls of a thousand dollars yearly, could all these be caught above. Some of the weir owners say further that the majority of the people of Nobleborough and Newcastle are quite willing they should still exercise the privilege of fishing, and that only a few interested persons desire to deprive them of it. We are of opinion that if the people of the two towns, or a majority of them, desire that weir fishing or taking alewives in any manner, except at the falls, under their management be prohibited, it should be granted.

Sheepscot.

The river was once prolific in all the kinds of migratory fishes common to Maine. But as in other cases dams have been built without fishways and the ordinary result has followed.

Salmon come every year to the lower falls in Alna, half a mile or more above the head of the tide, but are not able to pass it.

One man saw last year sometimes as many as five or six at once at the foot of the dam, and speared two. Shad are seen at the same place, and of alewives a man can sometimes dip one hundred in a day. There is some fishing with weirs at the head of the tide; sometimes three of them are built, but this year only one, which is estimated to have caught 1,000 shad, quite a number of bass, alewives, &c. These weirs are described to us as being built entirely across the stream; in the center is a gap which is open during flood, but closed with a bag-net at ebb tide.

About thirty years ago the dam at Alna was carried away by a freshet, and the fish had access to the river above. Mr. David C. Pottle informs us that the very next year they came into the river in far greater numbers than has been known since old times. This is a phenomenon we cannot explain. It encouraged the hope that these numbers might be retained, and on the re-building of the dam a fishway was constructed, but it did not work well and soon went to decay. The present owners of the dam express a readiness to construct a good fishway. There are several places above where it is supposed that fishways would be required.

Kennebec and Androscoggin.

For certain reasons it is more convenient to view the fisheries of the Kennebec and Androscoggin together. In our last report they were all regarded as belonging to the Kennebec. Yet the Androscoggin is hardly to be rated as a tributary of the Kennebec. The true line of demarkation between the two would be drawn in Merrymeeting bay; the waters of the Cathance and Abagadassett being considered as tributary to the Androscoggin.

These fisheries were not examined last year, although a certain amount of information was gathered respecting them and presented in the report. A considerable part of June (1868) was devoted to a personal examination of them. The instruments of capture employed in the summer fishery are shoal and deep weirs, seines and drift nets. Set nets are no longer employed on these rivers. The fishery for smelts, carried on in the fall and winter, is not included in these estimates. The drift nets are very irregularly used and we find it difficult to estimate their numbers or their catch. The number and distribution of the weirs is as follows:

		No. of Weirs.
Between Merrymeeting bay and the sea, about		41
In Merrymeeting bay, Androscoggin branch.		
Outside of Brick Island,	2	
On Brick Island,	2	
Androscoggin Channel,	7	
Cathance Channel,	6	
Abagadassett Channel,	8	
Flats near Abagadassett,	1	
	—26	
Kennebec branch.		
West side,	5	
East side,	8	
Swan Island,	4	
Eastern river,	2	
	—19	45
		86

We have been more minute in the statement of the weirs in Merrymeeting bay, because they are supposed to have had much to do with the decline that the summer fisheries have experienced during the last fifteen years, and because they are of a far more formidable character than those on the lower part of the river. Of the forty-five weirs erected this year above the Chopps, (the outlet of Merrymeeting bay) one, the uppermost on Swan Island, had no pound for taking fish, but depended upon a net set at the end of the hedge; another was improperly built and ineffective; of the remainder, all well built weirs, one (that between the Abagadassett and Kennebec channels) was an ordinary shoal weir; two were broken down early in the season, leaving forty deep weirs of various degrees of efficiency in operation during the past season. This is about the number built each year, the same sites being occupied for many years in succession. It should however be remarked that two of them are double weirs, that is, have two setts of pounds and two hedges, the second being on a line with the first and built out directly from it further into the channel.

The length of the leader or hedge and the depth of the water in the fish pound vary of course with the conformation of the ground.

In some cases it is necessary to extend the leader across broad flats in order to reach the desired depth; in others the channel runs close to the shore. As a general rule the deeper the water the more productive is the weir, yet in many locations the exten-

sion into very deep water does not pay for the extra expense. In the course of our examination soundings were taken at the outer side, and sometimes on the inside of many of the weirs, and the results reduced to a low water standard.

Of the weirs built on the Androscoggin channel we examined five situated on the southern shore, and all were found to be within the limits prescribed by the law for the Kennebec,—namely, ten feet maximum depth at low water. It is a matter of doubt whether that law applies to these waters. It would certainly seem that if the Androscoggin river was intended to be regulated by it, there would have been a provision whereby some of the counties on that river would have been represented on the board of wardens, whereas they are appointed only from the counties of Sagadahoc, Kennebec and Somerset. However, the people interested seem to have considered themselves bound by the law. It appears to have been the practice of the owners of weirs in this river as in the Kennebec, to extend their weirs into much deeper water than ten feet. The people who are interested in seine fishing further up the Androscoggin, believed that they were being robbed of their rightful share of fish by these deep weirs, and in the absence of officers, determined to take the matter into their own hands. Accordingly in the spring of 1867 they came down from Brunswick and ordered certain weirs to be curtailed. One man who had built his weir on the flats was obliged to remove it at considerable loss to the Bath shore. On the opposite side of the river the netting was forcibly stripped from one of the weirs and hung upon the stakes.

In 1868, a notice signed by certain men in Brunswick, headed by a Mr. Storer, was sent to the weir owners, that the law respecting weirs should be enforced. Mr. Storer came down again in June to inspect the weirs, and pronounced himself satisfied with those on the south shore, but found some fault with those at the entrance of Cathance river. It is certainly to be regretted that the necessity should exist for any such irregular proceeding as the forcible removal of a fish weir by private individuals, but in the absence of any efficient officers we hardly see how they could in any other way protect themselves in what they esteemed *their* rights. Yet we must say that the obstructions on this channel appear to be less formidable than those on any other channel *entering* Merrymeeting bay.

The six weirs built in Cathance river vary in depth at low water at the entrance, from seven feet to fourteen and one-half; at their

outside from nine to fourteen and one-half. The most formidable are the first on the south side, belonging, we believe, to Robert Curtis, and the two uppermost, belonging to Jellison, Raymond & Co. Mr. Curtis' weir measures fourteen and one-half feet at the entrance of the first pound or "pasture," and the same at the outer side of the fish pond. The two owned by Jellison, Raymond & Co., are opposite to each other, and are built in the deepest water of the channel, which happens here to be along the two banks, the water in mid-channel not being so deep by two feet as inside their northerly weir. From the entrance (on the landward side) of their south weir to the low water mark is fifty feet or more,—probably more; for at forty feet distance shoreward from the entrance there is five feet at low water.

Abagadassett river is even in a worse condition than Cathance. It is a smaller river, yet seven or eight weirs have been built in it this year, and they have been pushed far out into the narrow, crooked channel. At low water the weir built above the lower bridge by Messrs. Preble, was seen to stand in the very middle of the channel and to occupy one-third or more of its width; the same may be said of that built by J. W. Cushing, not far below the bridge; and those farther down are not much better. The leader of one of them extended quite across one small channel. The weir at the lower end of the flats between the Abagadassett and Kennebec channels is one of the deepest, measuring at low water fourteen and one-half feet.

On the Kennebec channel the weirs are generally deeper than on the others. That at Abagadassett point, built by Capt. Robert Jack, measures about twelve feet, the two of the Preble Brothers eleven and fourteen respectively; that of Maxwell, fifteen; on the south end of Swan Island flats two built by J. L. Brown, seventeen and fourteen feet. The first weir on the east side of the Kennebec is built by Winchell Lilly and others, of Dresden; this is a double weir, and is the most formidable, as well as probably the most profitable on the river. It is built across one channel of fifteen feet depth at low water, across a broad shoal, and into the edge of the main channel of the river. Its leader has about 450 stakes and its entire length is not far from one hundred rods. The inner pounds are at something more than half the entire length of the leader from the shore; at their entrance is twelve feet of water, and between them and the shore the water is fifteen feet deep. The outer pounds have a depth of ten feet. This weir is reported

to take a great many salmon. We know of its having caught three salmon in a tide on several occasions in June last, while not one of the weirs above it on the same side of the river had caught a single salmon up to the twenty-fifth of June.

The weirs on the east side proceeding upward, and their depths, are as follows: A. Reed and Lilly, eleven feet; Thwing, sixteen feet; Hawthorne, seventeen feet; Thwing and Perkins, sixteen feet; Perkins, six feet; W. W. Walker & Co., taken up before June twenty-fourth; Clancy and Lewis, eleven feet. In Eastern river, D. Clancy, eleven feet; W. W. Walker, thirteen feet.

It will be seen that a great part of these measurements exceed the legal limit of ten feet. In fact very little regard has been paid to that or any other legal restriction since the passage of the act limiting the pay of wardens to twenty-five dollars a year each, they bearing their own expenses. That measure was introduced and carried through in the interest of the weir builders, for the express purpose of destroying the efficiency of the board of wardens. It is to be sure averred that one of the wardens was commencing suits for the purpose of lining his own pockets with his share of the fines, and it is complained that those prosecutions for violation of the law were costing the public a great deal of money; but we have heard nothing which tends to show that the wardens did anything more than it was their duty to do. It is not denied that violations of the law were numerous, and we think the offenders are the parties really responsible for the cost which their prosecution entails. And if the wardens failed to execute the law fully, it was not for want of zeal and determination, but in consequence either of a want of personal acquaintance with the business of fishing, or of a defective law. It is very certain that a law requiring a gate to be opened in a weir ten feet under water, and be kept open certain days in each week is difficult of execution against the will of the owner, unless an officer who is well versed in the construction of weirs is close at hand on every unlawful day. The fishermen with whom we talked on this subject did not attempt to conceal the fact that they had circumvented the wardens and evaded the law, and some amusing stories are told of the manner in which the officers were outwitted. At present no pretentions are made to the observance of the law. Of course it is folly for an officer to attempt to enforce it on twenty-five dollars a year. The wardens can do scarcely anything more than hold their yearly meeting as provided by law. The supervision of fishways also

devolves upon them, but for the same reason it is out of the question for them to do anything about it.

The weirs between Merrymeeting bay and Bath are partly deep water and partly shoal water weirs. The conformation of the river does not favor the building into deep water to such an extent as in the bay.

Below Bath, the weirs, with a single exception, are shoal weirs, having "pockets" with board floors near low water mark. The exception is a deep weir like those of Merrymeeting bay, built the last two seasons on Crow Island, at the mouth of Back river. Two others of the same kind were constructed last year, but as they did not pay, the experiment was not repeated. The locations on this part of the river where deep weirs can be operated are very few. When the tide is out the water must be slack enough to allow a seine to be used in the fish-pound. It is complained by the fishermen up the river that these lower weirs are kept up too late in the season and destroy vast numbers of the young shad and alewives on their way to sea.

The fishing season proper closes as early as the middle of July, and the object of maintaining the weirs in effective condition after that is to catch bait for the cod fishery outside the river. We presume it was for this reason that by law that part of the river below Fiddler's reach was excepted from the operation of the fishery law, giving to the people of this section the privilege of fishing when and how they please. In consequence of this exception, that provision requiring the weirs to be stripped on or before the fifteenth of July is entirely inoperative; for the fishermen of Merrymeeting bay of their own accord not only strip their weirs but take them all up before that date, and the law does not apply to that section where weirs are kept up later. But the practice of the people in this favored section is not uniform. Some perhaps take up their weirs as soon as the upward run of shad and alewives is over; some merely take the netting from the pockets; some take off the netting but maintain the other pounds in effective condition for taking bait; while a few keep on the netting till late in the fall. The bait appears to consist of herring, (sometimes known as *English herring,*) scattering alewives, some full grown, some half grown, many bluebacks, a few young shad; pogies and various other species stray in with them from the sea. Sometimes a large number of pogies will be caught in a weir, or of mackerel. We are informed that some of the weirs are kept up through the fall to catch

smelts. The sea shad, too, are taken in the summer for some time after the run of river fish, but they have of late years been very scarce. This is attributed to the blue fish which are rapidly increasing in numbers, (breeding on our coast,) and run into the Kennebec at the time when the sea shad might be expected; but we are inclined to think the general decline of the shad has much to do with the decrease of the number that are found in the state called "sea-shad." How much injury is done by the destruction of the young of river fish we cannot say with confidence, and the testimony is conflicting. Several persons have said that they had seen young shad and alewives lying dead on the floors of the weirs, bushels of them together. Mr. Nathaniel Perkins, of Hunnewell's Point, who has fished there for forty years, says they are not caught and destroyed by the weirs whose pockets are constructed of netting, because they can and do freely pass through the meshes and escape, and that he never knew an instance of their being destroyed in that way. On the other hand, Mr. John C. Homer, of Bucksport, who has built a weir there ever since 1825, says that every year he sees young alewives two or three inches long, coming down the river in large schools; that they run into the weirs and do not know enough to go through the meshes; that many are eaten by eels, and the rest left on the floor dry. We are inclined to think there is truth in the assertion that these young fish do die in the weirs very often. We have seen them repeatedly in pockets, when the water had fallen so low that escape was no longer possible, and a fall of a few inches more would certainly leave them dry, notwithstanding that the meshes were sufficiently large for them all to pass out had they made the attempt. It is the same with other small fish. We have seen a school of young herring not two inches long embayed in a weir, and about to be left bare, although the meshes would have been no hindrance to the passage of fish twenty times their weight. For this reason we doubt whether the use of a slightly larger mesh on the pockets, as recommended by some, would obviate the difficulty. Still, it may be that the loss of fish from this source is inconsiderable. It should be borne in mind that the death of a single fish that has arrived at maturity has really far greater effect to depopulate the waters than the death of many young. And this is the reason:—the greater part of the young of shad and alewives and of most other species, fall a prey to stronger than they; and of the vast numbers that are hatched in any breeding river and start for their feeding grounds in the sea, a very

small part probably return to the river. We presume it is within bounds to say that the man who kills one five pound shad on her way up the river to spawn, is doing more harm than he who kills fifty young on their first journey to the sea. Now then, it may be made to appear, notwithstanding there is a considerable destruction of young fish by these weirs, that they are doing no more harm than the same number of weirs fishing during the ascent of the breeding fish, and that the capture of such bait as they take for the cod and hake fishery, is of quite as much importance in the production of food as is the capture of full grown fish for direct consumption. There is, however, another argument bearing on this point that we have not considered, and that is the catch of salmon. Should this species become much more abundant it would pay the owners of weirs to maintain them much later in the season than the fifteenth of July for the sake of salmon alone; and this might interfere seriously with their increase, so that it might be necessary to remove all obstructions much earlier than the people would now be willing. A little more research is needed in this matter.

There were two seines used this year near Augusta, neither of which did a paying business, and six in the Androscoggin. Whether any was in operation in Eastern river we did not learn. Those in the Androscoggin have not done well this year, and their very earnest attempts to have the weirs restricted are very good evidence that their profits have been seriously impaired for some years before. Their dependence is upon shad, and of these they appear to catch more than could be done on the Kennebec. Mr. Daniel Hunter, who runs a seine near the bay bridge, says that seven to ten thousand shad is a fair catch; but we suppose this is better than has been done of late. Mr. Hunter's catch up to 23d of June this year was only 1400 shad. He has not caught a salmon for several years—few bass, and not more than two hundred alewives yearly. The fishing season is from the 6th or 20th of May to the last of June.

We have heard from various sources the complaint that these seines on the Androscoggin have been very destructive to the shad by "sweeping out great quantities of spawn from the spawning beds." It has been described as coming out in a bulk by the "cartload." Now all that we know of the reproduction of shad tends to render this story very improbable. It is not supposed that shad cast their eggs in heaps, and even if they did, it is known that the eggs are very light, and do not adhere in any degree to

each other; so that it would be impossible to draw a mass of them ashore—they would all easily slide through the meshes and escape. But the story may have easily arisen from the fact (as we have reason to suppose it is,) that many ripe shad are often taken in large numbers, and as they lie in bulk the spawn is pressed out, and may accumulate in heaps on the ground or in a tub.

There is another complaint against the Androscoggin fishermen which appears to be more reasonable. It is said that at the mouth of a small stream, somewhere above Bay Bridge, where smelts are accustomed to run in the spring to spawn, and where it has been the custom to dip them, for several years a seine has been used, and tons of them were taken out when nearly worthless for food. Many were shipped to New York, and commanded a price that hardly paid for transportation. This is an abuse that should be stopped. We think no smelts should be taken during the spawning season—say from April first to June first. Enough can be taken in the fall and winter, when they are in good condition, and it is wonderful that they can stand the draft that is then made on their numbers.

It seems to be the general opinion among the fishermen of the Kennebec that the time has come for a radical change in some direction or other to save the fisheries from destruction. There is, to be sure, very little harmony in their views of a remedy. The different classes of fishermen too generally exonerate themselves from all blame and throw it upon the other classes.

Self interest will warp the judgment of most men. But we have found only one man who thinks that the fish are not decreasing in numbers, and his experience only extends over a period of seven years. With this single exception, the many with whom we have conversed have agreed that the shad and alewives have fallen off alarmingly within fifteen years, and that they are now rapidly diminishing. All agree further in blaming the dams and insisting upon the necessity and justice of having good fishways over them. Nearly all further agree that the deep water weirs are in a great degree responsible for the decline since 1852, about which time they were first introduced. Even some owners of these weirs have confidently stated to us that they believed they were a curse to the river and ought to be forbidden; and many of them have declared that unless fishing speedily revived they must give up the business. All the facts brought to light by our investigations in this matter during two summers have tended to show

that since the building of deep water weirs has been introduced, there has been a decline in the numbers of certain species which can be attributed to no other cause; that they are peculiarly deadly since they lie directly athwart the way of ascending fish, which seek to follow the banks of the channel; that if such weirs could and should be built generally on the lower part of the river, the almost utter extinction of the river fish would be the result. We advise that all river weirs be restricted to low water mark.

Introduction of Black Bass and Land-locked Salmon.

No attempt has yet been made to introduce black bass. We do not know of any experiments with the spawn of this species. They have been introduced to many new waters by carrying the live fish. The most extensive transportation of which we have any accurate account was accomplished by Dr. W. W. Fletcher of Concord, N. H. He was employed by the Commissioners of New Hampshire to introduce black bass to some of the waters, and succeeded in bringing from Lake Champlain, and liberating in good condition in New Hampshire waters several hundred (we think the exact number was 221), at an expense of about three dollars each. Dr. Fletcher thinks they could be brought from the same point to Maine for five dollars apiece. We are of opinion that no fish promises to thrive so well and give so much satisfaction generally in our perch and pickerel ponds as the black bass. But as there are several species known by this name, it might be well to ascertain whether the species inhabiting Lake Champlain is the best, or is equal to any other kind of black bass.

During the fall of 1867, an attempt was made to obtain the spawn of the Sebago salmon, in order to introduce the species into new homes. After much time expended, several thousands of the eggs were obtained in Harrison, properly fecundated as we believed at the time, and now believe, packed in baskets of bog moss and brought by stage and rail to Manchester, where they were deposited in some hatching troughs prepared to receive them. They were carefully tended, and to inexperienced persons appeared to promise favorable results until long after the time when they should have shown some decisive development. Yet of the whole lot we only know certainly that *one* hatched. The cause of the failure we were for a long time unable to even surmise, for everything had been done as nearly as possible in accordance with the directions of the authorities. But we now entertain no doubt that

the cause of the failure was transportation too soon after fecundation. During its early days the principle of germination in the egg is easily destroyed; it requires quiet and plenty of pure water. But when the young fish is once fairly formed, so that it can be seen with the naked eye, it can be safely handled and carried long distances packed in some damp substance. The eggs in question were packed up and transported immediately after fecundation. We were led to expect success from the apparent success of Dr. Fletcher's first attempt to introduce salmon by the egg from the Miramichi river to New Hampshire in 1866. His eggs were packed up directly after being taken from the fish; the most of them were planted in the Pemmigewasset river where their fate could not be known, but of several hundreds taken and hatched in a spring, ninety per cent. hatched. Still, general experience has been against Dr. Fletcher's. A gentleman in Boston has informed us that he has tried the transportation of eggs of brook trout from Rangely lake, after they had been fecundated one week, and met with a failure nearly as disastrous as ours.

This year we determined to try again, and to obtain the eggs from Grand Lake stream. Accordingly we went to the outlet of Grand lake on the 24th of October, and made preparations to take the spawn. Search was made for a suitable spring, and one that would answer our purpose was at last found within half a mile of the stream. A large basin was excavated and walled in with seasoned timber, and a rough house built over it. A number of sieves were floated in the basin, in which the eggs were to be deposited as fast as obtained—this being the best arrangement we could make in the short time left before the spawning of the salmon.

We had made no preparations to take fish in any way except by hook, relying on the confident statement of our assistant, an experienced fisherman, that he could take them in plenty when just in the proper condition, with the hook. The statement was partially justified by the fact that many females seized the bait with avidity, from which a few eggs flowed with the slightest provocation; but in every such instance it was found that these eggs were the last remains of the season's spawn, and in no case did such a fish yield more than twenty or thirty eggs. A large part of the eggs were obtained from fish speared by Indians; the remainder from fish caught with the hook and confined in baskets and floating cages until ripe. The first ripe fish was found on the night of the 26th of October, but the spawning season was not at its height

until about the fifth of November. It was necessary to await the partial development of the eggs deposited in the spring, and it was not until the tenth of December that it was thought safe to pack them up. The development was doubtless retarded by the variation of temperature in the sieves, where the water was found on the coldest morning, that of December tenth, to be several degrees colder than that outside, in the basin, and the latter had fallen below the normal temperature of the spring.

The eggs were packed in tin boxes of bog moss (*Sphagnum*,) and these tins in baskets of drier moss, sawdust, &c. A portion were sent, according to agreement, to the Massachusetts Commissioners, who contributed to the expense of the expedition. The greater part of the remainder were brought to Manchester and deposited in hatching-troughs erected last year, where after all losses by imperfect fertilization, and by transportation, we have several thousand eggs in which the embryo fish is distinctly visible.

Some eight hundred eggs were deposited in a stream tributary to Cathance lake.

Hatching of Shad.

Believing that an acquaintance with the mode in which the eggs of shad can be taken from the parent fish and successfully hatched into living fish, would be of much practical utility, should it become necessary in the process of restoration to introduce the fish again to the waters from which they had been long excluded, some experiments were undertaken last summer in the Kennebec. The place selected for operations was the seining ground of Messrs. Tibbetts and Dennen, in Augusta. Being busily occupied elsewhere, we were not able to commence until near the close of the fishing season. The first lot of eggs was taken on the night of June 28th, and the operation continued each night until July 4th. It was necessary to operate entirely by night, for during the day but very few shad could be taken. The results obtained did not vary much from those obtained by the experiments at Holyoke on the Connecticut, under the auspices of the Massachusetts Commissioners of River Fisheries, and reported by them last year. We will, however, briefly state the mode of operating, and some of the results.

As each "haul" of fish was brought on shore the shad were examined, and such as were ripe, emitting either eggs or milt on being gently pressed, were laid aside. As soon as they had ceased

to struggle violently, one of the female fish was taken in hand, held above a pail partly full of water, and the eggs pressed into it. A male was then taken and from him the milt or male element was expressed into the same dish. The other fish were treated in like manner. After standing awhile in the pails, (varying from a few minutes to several hours,) the eggs were deposited in the hatching boxes. These were of boards, about eight inches deep, of various lengths and breadths, with wire cloth bottoms. They were made to float in the river attached to a boom where the current was gentle on the flood tide and rapid on the ebb, but always in the same direction. The current kept a constant circulation of water through the bottom of the box, and in some cases the eggs were in a constant state of agitation, but without injury.

The temperature of the water was from 70° to 75° F., and the period of incubation varied from seventy to near one hundred hours. When taken from the fish the egg measures in diameter not quite one-twelfth of an inch, but water is rapidly absorbed by the outer coating until the diameter is more than one-eighth of an inch. The eggs are so nearly transparent that they can hardly be seen when lying in a pail of water; but when placed in a position favorable for the eye, the process of development can be traced at every step. At eighteen hours from impregnation the vertebral column can be distinctly seen; at thirty-four hours the eyes are plain and the heart is beating; at seventy hours the young fish bursts his covering and swims free. The unfecundated egg also undergoes development up to a certain point, being for a time undistinguishable from the fecundated; but it always stops short of the formation of the vertebral column, or any development in which we can trace the form of the young fish.

As soon as all the eggs in a box were hatched, they were turned into the stream; young shad begin to feed early and bear confinement with nothing like the patience of trout or salmon. It will doubtless be found practicable to feed them and confine them for a certain length of time, but how to do it successfully is not yet discovered.

In these experiments probably one hundred thousand (100,000) eggs were manipulated, and half of them hatched and turned into the river. This is too small a number to amount to anything economically, and there is no place in the State where shad can be hatched on a sufficiently great scale. There would be no difficulty in hatching them by millions, could the necessary number of ripe

fish be caught. We did not succeed in getting from each fish the large number of eggs reported by the experimenters at Holyoke. Not a shad that we manipulated yielded more than five thousand eggs, whereas the ovaries really contain many times that number.

There are some reasons, however, for considering the result satisfactory. It is really very good success to hatch fifty per cent. at the first attempt; that is much better than nature would have done. We have besides ascertained that the eggs of shad can be obtained in the Kennebec to stock any river that may need it—at least to start a new brood in any exhausted stream. To carry live fish, particularly shad, to any considerable distance and put them into a new home in good condition is a work of great difficulty; but the eggs can be carried and hatched with the greatest ease.

Some study was given to the reproductive habits of several other species—among them the little smelts of Monmouth, of famous flavor, and the large smelts of Sidney and Belgrade, that weigh frequently three quarters of a pound each; both of these are fresh water species, quite distinct from the smelt of the tide waters and from each other, running up into the brooks in spring, and depositing their eggs on stones, sticks and weeds, where they adhere tenaciously until hatched. They are among the very finest of edible fishes—next to the white-fishes, perhaps. The white perch, (*Merone Americana*, Gill,) received some attention, but we are only able to say of this species that in the Kennebec and the Penobscot it spawns in June and July, at which time we were occupied. The striped bass, (*Roccus lineatus*, Gill,) was also found in the breeding state in the Kennebec about the first of July.

Suggestions toward a revision of Fishery Laws.

In our investigations during the past two seasons, we had constantly in anticipation a revision of the fishery laws. Those on the statute books are very numerous and of very diverse character. As stated in the former report, the whole number of them in force at the present time is about one hundred and fifty, and they are increasing at the rate of eight or ten yearly. They are founded on no common system, and the officers to enforce them are without organization and generally without efficiency. It must occur to every one, that with such a similarity as exists in most of our rivers, their fisheries can be regulated by the same general provisions, that there need be a variation only in minor details, and that responsibility will greatly augment the efficiency of the

officers. We have now proceeded so far in our investigations that we can with tolerable confidence advise a general repeal of old statutes, and suggest the main features that should be embodied in a new code. We therefore submit the following suggestions as to the provisions of the proposed new law:

First, That a board of commissioners be appointed, who shall have general supervision of the fisheries through the State.

Second, A board of wardens for each river basin.

Third, No drift nets to be allowed in any of the rivers or lakes.

Fourth, No weirs or other fixed engines of capture to extend below low water mark.

Fifth, No weirs or traps to be used in any except tide waters; nor any nets except a dip-net, for five years, and then the nets should only be used for the migratory kinds.

Sixth, All fishing for salmon, shad and alewives to cease on the fifteenth of July, except hook fishing, which shall cease on the first of September.

Seventh, A weekly close time of two days, during which all weirs shall have open gates.

Eighth, No salmon or trout to be taken during October, November and December.

Ninth, No smelts to be taken in April or May.

Tenth, All weirs, seines, and other implements except hook and line, used in catching salmon, shad, alewives, smelts or bass, to pay a license fee of ten dollars.

Eleventh, Some legislation, if any is necessary, to give adequate protection to any person who may engage in the cultivation of fish.

For some of these recommendations it is proper to state our reasons, and to suggest some further details.

First, The existence of some supervising officers is deemed essential to secure the proper enforcement of the law, and the vigorous advancement of the measures for the improvement of the fisheries. The members of this board should hold office for more than one year,—say for three years. They should be authorized to examine the dams and other obstructions existing in the rivers, to decide upon the proper form and location of fishways and cause them to be built in case the owners of the obstructions fail to do so; to visit all sections where fisheries are carried on and examine the working of the laws; to introduce and disseminate valuable species of fish; to revise any minor regulations that the boards of

wardens may be authorized to make; to issue licenses; and to report annually to the Governor.

Second, The boards of wardens should be appointed by the State, should be sworn to a faithful performance of their duties, a penalty being affixed to neglect; should have power, and it should be their duty to enforce the law; to seize all implements of fishing found in illegal use, and to bring the offender to justice; to decide upon the plan and location of fishways, subject to the approval of the commissioners, and to enforce their building subject to the same approval; the number of men appointed and the compensation allowed them should be sufficient to ensure the full execution of the laws. In the case of certain rivers like the Saco and St. John, the appointment of wardens might be deferred for a time.

Third, No drift nets should be allowed. Our reasons for this are that drift nets, owing to their mode of use, are exceedingly difficult to control, are destructive and wasteful in their operation, and if permitted are capable of being multiplied to such an extent as to be very detrimental. While weirs are stationary and seines can only be used in a few localities, where the fishery officers will always be able to see their operations, the drifter, if permitted at all to pursue his mode of fishing, will find but little difficulty in eluding the vigilance of the wardens and extending his operations within forbidden limits. Again, an increase of the numbers of the fish would be a great inducement for many persons to engage in the drift net fishery,—so many as to render a limit to their number quite necessary. This limit would be difficult to maintain since the nets are not stationary. We do not consider it desirable that fish should be caught in this way, for all that can be spared each season from the stock of breeding fish will be taken by the modes permitted. It is well argued by Mr. W. H. Venning, in his report on the fisheries of New Brunswick, that if, while the shores are studded with weirs and set-nets the channel should also be occupied by drift nets, no fish could possibly ascend to their breeding grounds. The arguments generally urged in favor of drift nets are that they are the poor man's mode of fishing and must therefore be allowed, and that they are not very destructive. Neither of these reasons do we think are valid. When shad are the fish caught, a drift net will kill many that do not mesh enough to hold them, fall to the bottom and are lost. As to the other argument it is very certain that none but able bodied men can drift, and for such there is sufficient employment of other kinds to be

found. At the present time there are comparatively few persons who are engaged in this mode of fishing and scarcely anybody would be seriously injured or incommoded by its prohibition.

Fourth, The reason for the prohibition of deep weirs, so far as concerns the Kennebec, are given in our report upon that river, and we believe the same reasons will apply to all other rivers.

Fifth, The lake, pond and stream fisheries will not bear fishing in the productive modes employed with the migratory species.

Sixth, Experience in Great Britain and Ireland has shown that the most beneficial results follow from closing the salmon season early. The late fish are generally inferior in quality since many of them have been a long time in the fresh water. Yet we think the use of the hook may safely be continued somewhat longer than the more productive modes.

Eighth and Ninth, The forbidden months cover the breeding season of the respective species, and so far as we can see are sufficiently long. Perhaps whitefish and togue should be included with salmon and trout, although in some sections whitefish are only taken with the spear while spawning; in Moosehead lake they are taken with the hook. The fresh water smelts may be for the present excepted from the prohibition to take smelts.

The entire prohibition of all nets except dip-nets, of all weirs and traps, and the protection of the salmon family during the spawning season are, we think, all the provisions necessary to protect the fresh water fisheries from depletion. It may perhaps be necessary to extend the above season of trout and salmon another month into the winter; but we are not aware that any further protection is necessary for perch, pickerel and other species than is contained in the prohibition of nets. All the old laws upon the subject might safely be repealed. Yet we would advise exceptions to be made in favor of certain acts which will expire by limitation in a few years; for instance, the act of last winter in relation to the Sandy river ponds.

Tenth, It seems desirable that the State should derive something directly from the fisheries to assist in defraying the cost of protecting and improving them; and it is but just that those who are immediately benefitted should contribute directly. The license system will assist the officers in keeping the fishing establishments within reasonable limits, and it may prove the germ of a large revenue to the State.

There is a river of Scotland, the Tay, whose salmon fisheries are owned by a few individual proprietors on its banks; these fisheries are rented yearly and have of late brought the proprietors a sum equal to $75,000, gold, annually. Were all our waters to yield in that proportion, and we know no reason why they should not, our salmon fisheries would rent for *more than a million dollars in gold.*

Eleventh, We would call attention to the doubtful character of any private claims to natural bodies of standing or running water, and consequently to the fish that might be cultivated therein. It is sufficiently well established that large ponds and lakes are the property of the State; but how is it with smaller bodies? Are these also public property, or is there a point, determined by its size, where a body of water ceases to be public and becomes private property? If the latter, it is very uncertain where the point of distinction lies—whether at ten acres, at one acre or one rod. A legislative enactment authorizing private persons to appropriate and use water on their own premises or surrounded by them for the purpose of cultivating fish, would secure these interests and obviate the necessity of many special acts.

There should be some exceptions to the operations of these laws. For instance, the fisheries of Damariscotta and East Machias are well managed by their local communities, who evince a desire to retain their special laws. Some other cases may occur and should be considered. The exceptions made in the "act regulating certain fisheries," of last winter, should be retained.

Nearly all these provisions could take effect immediately, but those forbidding certain modes of fishing for salmon, shad and alewives should not take effect before the close of the next season, because persons engaged in those fisheries will have their preparations for next season far advanced before the new regulations could be promulgated.

Conclusion.

In conclusion we beg leave to urge that two seasons have now been almost wholly expended by the Commissioners in preliminary examination; and that the next should be the commencement of vigorous work in restoring the sea fish to our rivers. As intimated elsewhere, the first and by far the most important work to be done, is the construction of fishways. We have advised that it be part of the duty of the Commissioners to be appointed under the new law, to decide upon the location and plan of these structures, and

to enforce their construction. A sufficiently liberal appropriation should be made to enable them to push forward the work as fast as other circumstances will permit. Every year the reform is delayed the public suffers a loss of hundreds of thousands of dollars in healthful food. Our remarks on the Penobscot river will show that in that river alone there is an annual loss of several hundred thousand dollars by neglect of the fisheries. Public expenditure is a fair test of the estimate placed upon the fisheries by different States. We find the State of New Hampshire appropriating three thousand dollars in a single resolve for this same object that we have in view; the State of Massachusetts appropriating from ten to twenty thousand yearly; and these States have much less at stake than the State of Maine. The English Government expends $112,000 yearly on the fisheries of the United Kingdom, and we find the salmon fisheries of Scotland and Ireland producing annually, a sum equal to *four millions of dollars.*

Under a wise and liberal policy, there is no reason to doubt that the fisheries of Maine can be restored to something like their former productiveness.

All of which is respectfully submitted.

N. W. FOSTER,
CHAS. G. ATKINS, } *Commissioners.*

AUGUSTA, December 31st, 1868.

INDIAN CORN AND ITS CULTURE.

A LECTURE

By Hon. Joseph B. Walker, of Concord, N. H., before the N. H. State Agricultural Society; delivered at Manchester, Dec. 1868.

It has been for a long time a disputed question, whether the plant *Zea Mays*, popularly known as Maize or Indian Corn, is indigenous to this hemisphere or to the other; whether its origin was in the old world or the new. A question, seemingly of little consequence, and yet one which, upon examination, shows an array of authorities in support of either side of it, utterly appalling to a plain New Hampshire farmer—an array that ought to suffice to intimidate even a Philadelphia lawyer or a German theologian, if such a thing be inside the range of possibility.

But while this question has never been definitely settled, the weight of evidence indicates that Europe and Asia received this plant from America. It has been found growing wild in all parts of our continent adapted to its production, from Oregon to Paraguay. Indeed, there is abundant reason to believe that it was cultivated by the aborigines for centuries, and perhaps tens of centuries, before the first European foot had pressed American soil. According to Garcilaza de la Vega, an early historian of Peru, the palace gardens of the Incas were ornamented with beautiful representations of it in gold and silver, and we elsewhere learn that Columbus found it in a state of cultivation by the natives of Cuba, upon his discovery of that island in 1492. The Ojibways have a pretty tradition, as Mr. Schoolcraft informs us, that a young Indian, at his fast of virility, sought of the Great Spirit a gift that might benefit his race, and received in answer to his prayer the "Mondamin," or "Spirit's grain;" none other than our own maize, which the Indians have always regarded with profound veneration.

With them its cultivation was generally assumed by the females. It seems to have been a "woman's right," claimed by them in consideration of the hardships of war and of the hunt borne by the other sex. Her store of its golden grain was as much a source of pride and satisfaction to a worthy squaw, as is her spotless table, loaded with choicest viands, to a faultless housekeeper of our own

times. And, indeed, what richer sight can greet the eye than that of a shining heap of ripened corn-ears lying upon the ground and reflecting the genial rays of a mellow October sun? What so nearly resembles a pile of golden dollars,—rarely, alas! if ever, seen in these days of greenbacks,—as one of this resplendent grain? It is not difficult to appreciate the comfortable satisfaction with which these dusky corn-planters were wont to contemplate in autumn

> "——their maize fields grown and ripened,
> Till they stood in all the splendor
> Of their garments green and yellow,
> Of their tassels and their plumage,
> And their maize-ears full and shining,
> Gleaming from bursting sheaths of verdure."

The first corn crop raised in this country by European colonists was planted upon the banks of the James river, in Virginia, in 1608, the year immediately following that of the Jamestown settlement. When a little later, our Pilgrim fathers came to Plymouth, they found considerable stores of this grain, concealed by the Indians in the ground, not far from the place of their landing. The very next year, 1621, guided by instructions received from the natives, they planted the first corn-field ever planted by civilized men in New England. But whether the old world or the new can boast the origin of this plant is of little consequence to us. It came to our ancestors from the Indian; to them a richer gift by far than countless gems or gold, for they needed not those. Bread to sustain them they wanted, and land on which to found an empire, and these the Indian gave.

Indian corn is spoken of by the botanists as a grass. To many of us, perhaps, it appears a pretty tall grass, and a coarse one. Still they persist in calling it a grass, of which there is but one species, the different kinds being but different varieties of that species. In its primitive state each kernel is oftentimes covered with a husk or glume which disappears upon cultivation. Climate, soil and culture have, in the course of time, produced the numerous varieties, with many of which we are familiar. Some one or more of these are adapted to all the corn-growing localities of this country, thereby rendering the production of corn practicable almost everywhere within our borders. It varies in height from two to fifteen and even twenty feet, bearing its staminate flowers in panicles upon the tops of the stalks, and its pistillate ones in spikes inclosed in husks below.

In North America it flourishes throughout a range from north to south of forty degrees, and of twenty-three degrees in the United States alone; being raised successfully all the way from Canada to Mexico, and inside the tropics, from the level of the sea to a height of seven thousand feet above it. The northern limit of its growth is an isothermal line of sixty-five degrees above zero for two and a half months in each year.

In following such a line westward across the continent, we start on the forty-sixth parallel of latitude in New Brunswick, and thence passing on, we descend to the forty-fifth in Maine, and to the forty-fourth in New Hampshire, but suddenly rise to the forty-seventh near Quebec. Descending again in New York and Canada West to the forty-sixth, and still farther on, as we encounter the cooling influences of the Lakes, to the forty-fifth, we continue on that parallel almost to Minnesota. On reaching the vicinity of Lake Winnipeg we ascend to the fiftieth parallel, and as we pass still further west, in some instances to the fifty-first, the most northern limit of its successful cultivation on this continent. The line terminates abruptly at the one hundred and twentieth parallel of longitude, west of which it cannot be raised.

Indian corn is very flexible in its nature, and readily accommodates itself to surrounding circumstances. No courtier or politician is more so; but while it equals him in general flexibility, it possesses some fixed principles which are immutable under any and all circumstances. Each considerable locality soon modifies any new variety introduced to it, and imparts to it a character adapted to its soil and climate. As illustrative of this remark, I will state in passing, that I some years since procured from the town of Georgia, in Vermont, a variety of yellow pop corn. The ears were very tiny, many of them being not more than an inch and a half or two inches long. A few years' cultivation upon the interval, at Concord, enlarged them to three times their original size, and clearly demonstrated that such culture for a few years more would have changed this to a respectable variety of field corn.

The varieties of corn are more numerous than is generally supposed, no less than one hundred and twenty having been found, it is said, in Spain alone. As many perhaps exist in the United States. Almost any person conversant with this grain, will readily call to mind a score and even more, growing within the limits of New England alone. The ears of different varieties vary in length from one to eighteen inches, and in diameter from the half of one

to more than two inches. Some kinds have eight rows of kernels to the ear, some ten and twelve, and some more, even to the number of thirty-six. All flourishing in this section have the outside of the kernels rounded, smooth and horny, and are designated as flint varieties. Those most common in the West and South and to some extent in the Middle States have depressions upon the outside of their kernels, owing to a construction of the starch, in which they are rich, upon drying, and are known as the dent varieties. The kernels too, vary much in color. Some, like the common eight rowed and the Dutton corn, are of a light golden yellow; others, like those of the Brown corn, have the same color darkened and more reddish. The grains of the Tuscarora are of a creamy white, and those of the Webster of a pearly hue. Those of some other varieties, like the Mexican sweet corn, are black, while those of others still are red. At our old fashioned New England huskings, a chance ear of this last variety was highly prized by the sterner sex, and that more particularly on account of the privilege attaching to it than for any intrinsic superiority of quality it might possess. I hardly dare say it was an unpopular kind with the fairer portion of such parties. Some varieties are particularly rich in oil and gluten; others in starch; some in fat producing properties, and others in such as favor the production of flesh and bone.

Different varieties often require different periods of time in which to grow to maturity. Some will ripen in sixty days, some in not less than about two hundred. Those common with us require from eighty to one hundred and fifty. Our corn season is flanked by a frost at each end, and at longest, generally extends only from about the first of May to the middle of October, while in many localities this period is considerably abridged. It is useless therefore in most cases to rely upon kinds which require for their ripening more than one hundred and fifty days. And it is equally useless to plant when the ground is cold. Corn requires for germination a higher temperature of the soil than rye, wheat, grass, or in fact most of our other crops. Not until this has risen to about sixty-eight degrees for some considerable portion of the time will the kernel sprout and grow. The old Indian rule of planting when the leaves of the birch had attained the size of a mouse's ear, was doubtless founded upon experience and was a good one. The expanding leaves of the trees afford a far better guide than those of the almanac. It is far safer to re-

gard their condition than the day of the month. Some corn land in this valley, favorably situated, may generally be planted as early as the first of May. For most of it, however, the middle of that month is early enough, while upon the colder lands of the hills most of the planting should be done later by a week or ten days than that.

If planted at the proper time, corn will germinate and come up in from five to eight days, varying somewhat according to the warmth of the soil and the depth to which it is planted. It is undesirable to have it lie in the ground without sprouting much longer than that for fear of injury to the germ and of consequent loss of the expected plant. To mature it requires, as before remarked, a temperature of sixty-five degrees for two and a half months, or an equivalent to that. The thermometer may sink for days and even weeks below that point and the growth of the plant be much retarded in consequence, without detriment to it, provided a degree of heat sufficiently high to make good the loss, precede or follow the period of delay. We had an illustration of this fact the past season. The month of May was wet and cold. The average early morning temperature of June was only about fifty-four degrees, while that of July was less than sixty-four. On twelve days, however, of July, the mercury reached over ninety degrees and on the twelfth and fifteenth even to ninety-nine in the shade. During these hot days corn grew with astonishing rapidity and made good the loss it had previously sustained, so that on the first of August it stood as high on the hill as usual. But a season of more even temperature is desirable. While growing fast, the stalks are tender and liable to serious injuries from winds, which the hardiness incident to a more uniform or less rapid growth would enable them to encounter with impunity.

Indian corn loves best a deep, rich, warm, mellow, loamy soil, with a southern exposure. If sheltered upon the north, so much the better, particularly in the early and latter parts of the season, when in this latitude we are subject to cold northerly winds. Such a shelter will oftentimes secure to the crop a week or ten days of good corn weather both in the spring and autumn, which it would not have in a bleak situation, and render practicable the ripening of a larger and more profitable variety than would otherwise be possible. The lengthening of the ordinary corn season from two to three weeks by shelter, the selection of proper soil and other appliances is a matter of great consequence, and one which de-

mands the careful consideration of the corn growers in so cold a latitude as that of New Hampshire. Indeed, there is no one point in corn husbandry more worthy of emphasis than this, viz:—*Raise corn on corn land.* I have no doubt it may be produced upon a bog, by a little ridging to keep it from drowning, but I need not say with what success. We had some years ago a worthy old man up the valley, who did not belong to the temperance society, and who, one Saturday afternoon, being in a condition of entire impecuniosity, applied to a neighbor for the loan of a ninepence, with which to purchase "something to keep Sunday on," to borrow his own expression. His neighbor, reluctant to indulge him to his injury, but without a heart to refuse him altogether, mildly asked, "Can you not 'keep Sunday' on a fourpence, uncle?" "Yes," replied the veteran, with an expression of mingled despair and contempt, "yes, possibly I might, but what sort of a Sunday would it be?" So, we may raise corn on cold, wet soil, but what kind of corn will it be?

The manures at our command best adapted, all things considered, to the growth of corn, are those of the barn and the stable. These are the cheapest and at the same time the most reliable. Artificial manures are often dear and frequently of inferior quality. Of three kinds of superphosphate tested on my farm in 1867, in connection with corn, upon land fertilized by no other dressing, one was found to be entirely worthless, and the corn dependent upon it a failure. If the others had been applied at the rate of two or three table spoonfuls to the hill, they would have probably secured a fair but moderate yield. Until the farmer has some reliable guaranty of the purity and strength of the concentrated manures exposed for sale in the market, he will be wise to rely upon them but partially.

The office of a fertilizer is two-fold. First, to afford sustenance to the growing crop, and second, to assist in breaking down and converting to an assimilable state the insoluble silicates of the soil. When, therefore, we consider that the roots of corn extend laterally in the ground as far from the plant as do its leaves above it, it will be apparent that the food for that plant's support should be evenly distributed over the whole piece, instead of being confined merely to its hill; and that a thorough pulverization of the fertilizers applied are of much importance. The careless spreading of coarse, lumpy manure upon land devoted to corn will be very likely to produce a late and uneven growth, some hills being fed

to repletion, while others are starved or so far retarded in growth as to be compelled to encounter the autumn frosts long before they are able to bear them.

Do the best we can with it, this crop is liable to a number of accidents, each more or less serious in its results.

Frost will not unfrequently assail it, when but a few days out of the ground, and retard its progress; or in the latter part of the season, seize upon it when in the milk, to its most serious injury. About the only remedy for this lies in the selection of such varieties as will mature within the period marked by the latest spring and earliest autumn frosts.

The crow and blackbird are vexatious meddlers with this crop, particularly in the early period of its growth. I am not aware that the ingenuity of man has yet devised any panacea for the cure of this annoying evil. Scarecrows, lines, gunpowder, to even the stringent legislation of the General Court, whose supreme wisdom I would by no means doubt, have proved at best but partially successful. It is, in fact, one of those troublesome ills of which the late Moody Kent, with philosophic gravity would have said, the farmer has the very comforting alternative of grinning and bearing, or of bearing without grinning, as most suits his preference. While for such a consolation we should be duly grateful, it may not be wrong to pray that some day we may be still more grateful for one more satisfactory.

For a month or so after planting, the wireworm and the cutworm are often troublesome. The former generally frequents cold and wet lands and their ravages may often be escaped by planting on soils of the opposite character. Whenever ravages of the latter are apparent, the only remedy is at once to unearth and destroy them, and it will be found profitable to do this, even repeatedly, if occasion require it.

Considerable injury to a corn crop not unfrequently results from winds, at times, more particularly when the corn has been growing rapidly and is tender. It is most exposed to this injury when planted in long strips, running in such directions as to expose a broadside to the blasts.

At harvest it is often found that many of the ears are but imperfectly filled at the tips, an inch or two of the cob being destitute of kernels. Various causes of this have been suggested. Some persons attribute it to cold nights. Some to the injury or destruction of the silks attached to that part of the ear, which prevents the

communication to it of the fructifying influences of the pollen as it is showered down from the stamens above. But, whatever the true cause may be, the most practicable remedy for the evil will be found in a careful selection of soil and thorough culture.

Indeed, without a due regard to these two points, success in corn-growing cannot be expected. We can hardly overestimate the importance of careful and frequent stirrings of the ground by the cultivator and the hoe for the first four or five weeks after planting, whereby air and moisture are admitted to the roots, and the robberies of rank-growing weeds prevented. After the first of July, however, the crop must be left to itself, and the proprietor has simply to await the result in autumn.

Much has been said and written concerning the treatment of corn at harvest time. Some with great earnestness advocate cutting it down at the ground when nearly ripe and allowing it to perfect its maturity in the stook. Others are equally confident that it is best to remove the top stalks as the kernels begin to glaze over and allow it to ripen upon the hill. If the corn is of a small variety, the former method is in most cases the preferable one. It is the most expeditious, the fodder is more perfectly preserved, and by its adoption those parts of the crop not perfectly ripe are shielded from any frosts that may occur. If, however, the variety planted is a large one, having stalks from seven to ten feet high, the latter method will generally be found preferable. Under this, it is a common practice in some sections to cut and stook the top stalks about the tenth or middle of September, husk the corn upon the hill as soon as it becomes ripe and immediately after cut up and house the butts.

The yield varies according to variety, soil and culture, all the way from ten to a hundred and fifty, and even two hundred bushels per acre. The Supervisor of the Plymouth County (Mass.) Agricultural Society reports that, in 1858, George W. Wood, of Middleborough, raised eighty-one and forty-four fifty-sixths bushels on an acre, and that Robert Perkins, of Bridgewater, raised one hundred and two. Joseph Winslow, of Epping, in this State, says in the U. S. Patent Office Report of 1853, that he had raised between one hundred and eleven and one hundred and twelve bushels per acre; while John Brown, Sen., of Long Island, in Lake Winnepesaukee, and whose name attaches to the eight-rowed variety of which he speaks, states in the same volume that he had raised one hundred and thirty-six bushels per acre. Had we evidence

that the measurements of these last two crops were made with as much exactness as were those of the two first, we should be less inclined to accept them *"cum grano salis."*

A reference to my own farm journal reveals the mortifying fact that I have never been able to match even the smallest of these, having rarely, if ever, succeeded in raising a crop that would measure on the first of January following its harvest, when dry and fit for use, more than about fifty bushels per acre. I find by the record there preserved, that eight crops, raised from 1853 to 1861, measured in the bins immediately after harvest, allowing two bushels of ears to one of shelled corn, yielded as follows, viz. :—1853, 60 bushels per acre ; 1854, 50 ; 1855, 60⅔ ; 1857, 71½ ; 1858, 64 ; 1859, 50½ ; 1860, 43½ ; 1861, 73 ; being an average yield per acre for this period of fifty-nine and one-eighth bushels. Estimating the shrinkage upon drying at twenty per cent. we reduce the average per acre to forty-seven bushels.

Indeed, I cannot but consider fifty bushels to the acre of good, sound, dry corn a satisfactory crop. Such an one, when guessed at in the field by an obliging committee of an agricultural society, after a good dinner at the home of its proprietor, ought to amount to seventy-five bushels, and, if necessary, to even more.

The kinds of corn usually planted by the farmers of this State are the eight and twelve rowed varieties. The shortness of our seasons renders it unsafe to plant larger and later ones. The present exhibition of these at the State House, collected from all parts of the commonwealth by the Secretary of State, affords gratifying evidence that we are producing these in much perfection. Their improvement, however, is practicable and very desirable. Were the depths of the kernels increased without enlarging the size of the ears, they would afford a greater yield of grain, with little, if any increase of the expense of cultivation. Could the tapering of the ears, in the case of many of them, from the middle towards the tips, be lessened one half, the kernels would be latitudinally enlarged and the crop correspondingly increased. An important improvement would also be gained by securing a larger number of ears upon a stalk, which would result doubtless in a great augmentation of yield without a corresponding enlargement of the cost of culture. Mr. Flint, in his admirable treatise on Indian Corn, cites experiments made by Mr. M. Thomas Bayden, of Maryland, who, beginning with the common Virginia corn, having hardly two ears to a stalk, succeeded, after a trial of more than

twenty years, in so improving this variety that many of the stalks produced four, and some ten ears each. If our common eight rowed corn, which bears but one or two to a stalk, or our Dutton which bears but one, could be made to produce four and two, respectively, the corn crop of this state would be doubled. Could some of the larger varieties, before alluded to, be rendered earlier, they would be more generally planted, and our corn yield in that way perceptibly increased. And here, perhaps, I am met by the remark, "Why spend time in discussing the culture of Indian corn, an unprofitable crop at best, and decidedly so now that our farmers on their hard and rocky soils must compete in its production with those upon the fertile prairies of the West?" But should this competition discourage us? The freight and other charges incident to placing a bushel of western corn in an eastern market is some forty-five cents, and when there it generally sells at some ten cents less than one of northern growth. The majority of western farmers will probably realize, this very season, a net price of less than fifty cents per bushel for their crops.

But is corn-growing an unprofitable business in New Hampshire? Northern corn is quoted in the market at about one dollar and a half a bushel. What does it cost to raise it? This question will doubtless elicit different answers. I was told some twelve or fifteen years ago, by a farmer of much intelligence and long experience, that its cost was a dollar a bushel. Another, about the same time, demonstrated by a written statement, at an annual meeting of this Society, that he had, that very year, raised it for twelve and a half cents. A careful preservation of all the items of expense of a crop raised in 1861 showed me conclusively that my corn that year cost me about fifty cents.

With your permission I will here present a statement of the expense of four and a quarter acres of twelve-rowed Dutton corn, raised the past season. It is as follows, viz:—

One seventh expense of breaking up 4¼ acres of ground (broken for a seven years' course),	$6 09
One fourth cost of 32 cords of manure at $7 per cord,	56 00
One seventh expense of pulverizing, spreading and ploughing in same (11½ days $31.12),	4 44
Concentrated manures,	23 93
Marking for planting,	3 50
Planting and applying concentrated manures,	10 50
Hoeing 1st time, 11 days' work,	19 25
" 2d " 9½ " "	16 42
" 3d " 6½ " "	11 37

Cultivating both ways three times, ...	12 00
Cutting stalks, 9 days' work, ...	16 50
Getting in stalks, 2½ days' work, ...	5 00
Husking and storing corn, 14 days' work, ...	27 50
Cutting and storing butts, 6 days' work, ...	13 25
Whole expense, ...	$225 95
Deduct from this 10⅝ tons of corn and fodder worth, say $7 per ton, .	74 37
And there remains as the cost of (483 bushels of ears of sound corn and 25 of pig corn, estimated to be equal to half the number of shelled corn) 254 bushels shelled corn, ...	151 58
The yield per acre being 56¾ bushels of sound and 5 15-17 pig corn, or 62 43-68 bushels of both kinds. Calling this equal to 60 bushels of good, sound, shelled corn, and deducting therefrom twenty per cent. for shrinkage, from harvest to time the corn is fit for market, thereby reducing it to forty-eight bushels, we have, at $1.45 per bushel, an income of .	69 60
Deduct therefrom the cost of raising the same, ($151.58 divided by number of acres, 4¼)	35 66
And there remains a net profit per acre of	$33 94
Divide the cost per acre ($35.66) by 48 and we have as the cost of corn per bushel, ...	74 7-24cts.

If then, we can raise this grain at seventy-five cents a bushel, and sell it for about twice that sum, is it not a paying crop? What other field crop pays a larger net profit per acre, than thirty-three dollars and ninety-four cents?

The value of our Indian corn crop is not generally appreciated. It is the most important of any grown in the State. New Hampshire produced in 1860, of

Rye,	128,247	bushels,	worth	$1	per	bushel,	$128,247 00
Wheat,	238,965	"	"	$2	"	"	477,830 00
Oats,	1,329,233	"	"	50c.	"	"	664,616 50
Corn,	1,414,628	"	"	$1	"	"	1,414,628 00

It is apparent from this statement, based upon the Census returns of 1860, that, in quantity, it leads every other cereal,—the amount raised that year being eleven times that of rye, nearly six times that of wheat, and exceeding the oat crop by more than eighty-five thousand bushels.

The same marked difference will be even more apparent, if we consider the pecuniary value of these crops,—that of corn being more than twice that of oats, more than twice that of wheat, and more than eleven times that of rye.

As an article of food, it is of very great value. According to the Table of Nutritive Equivalents, prepared by Petri, from actual experiments in feeding, fifty-two pounds of Indian corn is equal

to seventy-one of oats, fifty-five of rye, fifty-two of wheat, and one hundred of good English hay.

For fattening purposes it is doubtless the most valuable of all our cereals. The following analysis, taken from the Report of the Department of Agriculture for 1865, will confirm this statement.

ANALYSIS OF INDIAN CORN.

Water,	15 00
Flesh-forming principles,	11 00
Fat formers,	66 70
Accessories,	5 30
Mineral matter,	2 00

But notwithstanding corn may be raised with entire success in this climate, and its culture is profitable; notwithstanding its great value as a food and the constant demand for it in all our markets, we are not according to it that degree of attention it justly deserves. We raised less corn in 1860 than we did in 1840; and, from the best information I have been able to obtain, New Hampshire is importing every year from other states to make good the deficiency of her own crop something like a million of bushels. Or, to state the fact in another form, she is annually sending abroad some three-fourths of a million of dollars which may and ought to go into the pockets of her own people, and increase to that amount the inventory of the state. Is this, fellow farmers, to your credit and mine? Does it not become us to awaken in ourselves a sufficient degree of enterprise to earn and claim this amount? We have but to increase our crop about seventy-eight per cent. to supply the whole demand of the state. By a judicious selection of better varieties and more careful culture, we may do this without increasing very much, if any, the area now devoted to it. Can we not do it? Will we not do it?

But God has declared in the book of inspiration that "man shall not live by bread alone." He has also declared in the book of nature that a varied industry is best adapted to advance the social interests of a people. While to us he has given a stern climate and soils rocky, but productive under skillful culture, he has at the same time uplifted within our borders the mountains and the hills, to wring from floating clouds their moisture, and send it back again to the sea, condensed through scores of valleys and over hundreds of waterfalls, supplementing thereby man's unaided power, and inciting to other labors than those of the farm. He has designed us for a manufacturing as well as an agricultural peo-

ple, and linked here those two quiet industries in amicable union that they may stimulate and aid each other. While our meadows and the wooded hills above them invite the plough, our numerous streams ask for the spindle and the loom. If we appreciate and improve, as we may, the great advantages His liberal hand has vouchsafed to us, our fields will become mines of wealth and the Manchesters upon our rivers rival in riches, in population and in power their older namesakes in the fatherland beyond the sea; and this fair city, with its hundreds of thousands of busy people, will stretch out its hands and invite to its markets the products of a surrounding country, grown richer far and more beautiful than the environs of old Damascus or imperial Rome.

[From Report Michigan Board of Agriculture.]

AGRICULTURAL SOCIETIES:

THEIR PROPER OBJECTS AND RIGHT MANAGEMENT.

The formation of agricultural societies, now so numerous in this and other countries, belongs chiefly to this century, though their origin dates further back. In Great Britain, the Highland Society of Scotland, the oldest in the kingdom, was formed in 1780. Some small associations of similar character may have existed on the continent of Europe at the same time. In our own country, the first steps toward such organizations were taken shortly after the close of the war of the revolution. Several gentlemen who had occupied prominent military and other positions during that contest, on returning again to agricultural pursuits, and seeing the low condition into which agriculture had fallen during the long period when the mental and physical energies of the people had been almost absorbed in the great struggle for national existence, resolved to associate themselves together for the improvement of that interest, which they well understood constitutes the foundation of the country's prosperity.

This association was organized in 1787, and was called "The Philadelphia Society for the Improvement of Agriculture." It numbered among its members, George Washington (as an honorary member), Robert Morris, Richard Peters, Timothy Pickering and other distinguished men. Pickering, who was Secretary of State under Washington, returned to Massachusetts, his native State, on leaving that office, and took an active part in the Massachusetts Society for Promoting Agriculture, which was formed in 1792, and included among its members many of the leading men of the State—the eminent Samuel Adams being its first President. The New York State Society for the Promotion of Agriculture, Arts and Manufactures, was organized in 1793, with Chancellor Livingston at its head, and Dr. Samuel L. Mitchell, John Jay, Horatio Gates and others as members. County societies, Berkshire, Mass., taking the lead, were formed in several of the States before the close of the last century. But it was not until the war of 1812-15 that these societies became general.

What has of late years been the main feature of agricultural societies was not for several years adopted by the earlier associations. In this country, the first society which attempted an exhibition, is believed to have been that of Berkshire county, Mass., which in 1810 held its first "Cattle Show," at Pittsfield. The "cattle" exhibited, however, are said to have consisted of two grade-Merino sheep, owned by Elkanah Watson, the President of the Society. The Massachusetts Society held its first exhibition at Brighton, in 1816. This appears to have been the first *State* exhibition in the country. The Society made annual exhibitions for many years. They attracted great attention, were attended by leading agriculturists from all parts of the country, and undoubtedly exerted much influence towards the introduction of similar exhibitions in other States.

Before the establishment of exhibitions, societies directed their efforts mainly to bringing out papers or essays, in answer to questions propounded. Much valuable matter was brought out in this way—matter which even now may be read with advantage. Some societies, like that of Massachusetts, offered premiums for the introduction of specimens of breeds of domestic animals, implements, seeds, &c., which were thought to be desirable. Merino, Leicester, and Texel sheep, and Shorthorn and Holstein cattle were introduced into Massachusetts under these offers. Premiums were also offered for experiments.

The Philadelphia Society published its doings in volumes entitled "Memoirs," &c.; the Massachusetts Society published its "Repository and Journal," and the New York Society issued its "Transactions." Any person who will take the trouble to look over these old volumes, will find that the men who were able to make a nation, were close observers of natural laws as connected with the growth of plants and the sustenance of animals, and that our indebtedness to them is not confined to the victories achieved on the battle-field and the advantages of a free government, but consists in no inconsiderable degree in facts established and improvements made in agriculture.

The fundamental idea in the origination of agricultural societies, was to better the condition of the farming class by introducing such improvements in the various branches of husbandry as would secure the best returns for the outlay of labor and capital. Affording amusement to the people, any further than amusement could be derived from objects of actual utility was not contem-

plated. This is undoubtedly the true ground-work for such associations. Of course the plan is intended to include encouragement to those branches of industry with which agriculture is connected. When legislatures incorporate agricultural societies, or provide for their organization, it is on the condition that they shall attempt the *improvement* of agriculture. It is with this view that they are allowed to draw money from the State treasury, or obtain it from the people. The matter may be regarded in the light of a contract, the officers of societies pledging themselves to use the powers conferred on them as specified.

The means by which agricultural societies can effect improvement may be enumerated as follows: 1. The holding of exhibitions at which premiums are given for specimens of superior merit or excellence in the different departments to which their supervision is extended. 2. The bestowment of money for making experiments to settle doubtful questions. 3. The publication of special papers or essays, comprising useful information.

Of these, the holding of shows for the exhibition of articles and animals is the most prominent, though not necessarily the most important. The influence of these exhibitions depends very much on the manner in which they are conducted. At the best, however, they cannot properly be considered as more than one of the various means by which a society should seek to accomplish its main purpose. Unfortunately, many societies make this their sole object, too often without due regard to management and ultimate results.

To effect the greatest good by these exhibitions, much judgment is required in the offering of premiums, and at least equal judgment, accompanied by a good degree of independence, is required in making the awards. In general the amount of the premium should be graduated by the utility of the object for which it is offered. Exceptions, however, may properly be made in reference to objects which require special encouragement for a time, or those the immediate introduction of which it is desired to effect.

An important object of societies should be to establish correct standards by which animals and things should be judged. The terms in which premiums are offered should be based on such standards, and should as far as possible convey a clear idea in regard to them. The mere use of the word *best* does not express anything as to what constitutes excellence. It is sometimes said

that this is left to the awarding committees. But it is improper to leave it to them, because different men are appointed to judge the same things, at different times, and their ideas in reference to standards of merit may not agree. Thus, instead of establishing uniformity in regard to the things judged, the decisions might nullify each other, and nothing would be established. A reasonable supposition is that the society seeks to make improvement in everything for which it offers premiums, and that it has fixed certain standards in reference to which the awards should be made. On this ground agricultural societies become, as they should be, correctors of public opinion. The animals or articles on which premiums are awarded, may properly be presented as examples for imitation.

The objects on which premiums should be offered, are numerous and need not be particularly enumerated. Unusual prominence has of late years been given by many agricultural societies to the horse. It is well known that under the name of "trials of speed," some societies have made racing and trotting matches the principal features of their exhibitions. It is not unusual that the largest premiums offered are those for the fastest trotting. A great display is made of this in the bills, and it seems to be relied on as the greatest inducement that can be presented to the public to attend the shows. The arrangement of the grounds, and the most expensive fixtures for the accommodation of the people, have special reference to these so-called trials of speed. So much space is frequently given up to this, that other departments of the exhibition are incommoded for want of room.

The excitement incident to these displays is naturally attractive to those people who attend the exhibitions merely for amusement, especially to the young of both sexes, and the crowd which lingers round the stand, shows that the benefit which might be derived from close examination of the more useful parts of the exhibition, is chiefly lost.

But is any real improvement effected or even contemplated by these premiums on trials of speed? We hear, to be sure, of associations,—sometimes with the pretentious title of "national,"—being formed for the "improvement" of horses. What improvement do they make, or even intend to make? Have any of them ever told us how or in what respect they design to effect this object? If it was really intended to improve the horse stock of the country, it would be natural that men of common sense and com-

mon honesty should lay down some plan for the accomplishment of this object. We have seen nothing of this kind; not a word has been published in reference to any proposed course of improvement, or to show in what respect any improvement has been accomplished by these displays. In fact, a pretty thorough acquaintance with the manner in which these horse-shows and trials of speed have been got up, leads to the conclusion that they are chiefly intended as means of making money for the keepers of hotels, gamblers and horse-dealers. The public at large are only paid in the amusement which the occasions offer, and that, as we shall show, costs more than it is worth.

But let us look a little at the principles involved, and the results produced by the fastest trotting at short distances with light weights—a mere test of speed, irrespective of other properties. It often follows that the winning horse is in many cases one of little value for any purpose of usefulness—that in some instances he would not bring in the regular market, as much money as is awarded to him in a single premium. It is true that this is not always the result of these trials. Horses that are valuable for something besides speed at short distances and light weights, do sometimes win; but when they do, they stand no higher in the scale of honors than the mean scrubs which have done the same thing; and it must be evident that the offering of premiums for mere speed, if it has any effect at all, tends to the production of horses in which the more useful properties are found only in an inferior degree.

But the worst aspect of the case has not been noticed. Disguise it as you will by any soft words, these contests are in principle, nothing more than those instituted by gambling associations, where horses compete for *purses*, in sporting phrase. Indeed, as the public mind becomes accustomed to the spectacle, it approximates nearer and nearer to the gambler's scheme until even now, we see at the exhibitions of some of our leading agricultural societies, the most open betting on these "trials of speed."

In view of these facts, will any one contend that the scenes alluded to are calculated to improve either the breed of horses or the morals of men? But what is the argument in favor of these displays? On what ground is it attempted to justify them? Their advocates, when pushed to the wall and forced to admit that they cannot stand on the ground of utility, claim, as a last resort, that you cannot get along without them; that they are necessary to

get money from the people. But what better is that than the raising of money by any other false pretense? Admitting that the money thus obtained is to some extent appropriated to useful purposes, the course of action cannot for a moment be sustained in the face of the interrogatory—"Shall we do evil that good may come?" But does not the evil which is inevitably attendant on these displays, decidedly overbalance the good which it is practicable to effect through them? Persons who have closely watched their influence on the public morals, will have no hesitation in giving an affirmative answer to this question. The argument that they are necessary to the support of agricultural societies, is believed to be entirely fallacious. Does experience teach that the class of people who are particularly interested in mere amusements,—innocent or otherwise—can be permanently relied on in important enterprises? On the contrary, is it not well understood that their characteristic capriciousness may at any moment jeopardize the success of any undertaking? Again, the true friends of agriculture are disgusted by frivolous and immoral proceedings, and stand aloof, or withdraw the support which may have been tendered, thus depriving the society of the aid of the most substantial and trustworthy citizens—the class which all experience shows can alone be depended on for the prosecution of enterprises designed for the public good.

But perhaps it will be asked, would you shut out the horse from any participation in agricultural exhibitions? Certainly not. The horse is one of the most useful of our domestic animals, and his improvement should not be overlooked by agricultural societies. Several classes or breeds of horses are required—the most important of which, in reference to the wants of this community, is the farm-horse. This is also the class which here most needs improvement. Next in importance is the roadster—a class suited to quick traveling, with comparatively light vehicles on the road. One point of merit in this class is, of course, speed in trotting, or at least that degree of speed which is compatible with the hardiness of constitution, and power of endurance necessary to constitute the most serviceable and valuable horse for this business. In awarding premiums on this class, it will obviously be proper to take into consideration all the properties required to make the best horse. As before remarked, one of these properties is speed, though not in a higher degree than is likely to be wanted by the horse in the performance of his legitimate duties. It will be proper that the committee under whose examination horses of this

class are brought, should subject them, as far as possible, to such tests as would be adopted by a person wishing to purchase a horse for honest business. He would, of course, wish to see something of the animal's action, both as to its style and rapidity; but he would by no means think it necessary that the horse should be put in competition with others on a track at the highest practicable speed. Even if it should be desired to test the rate of speed by time, the fairest mode of doing so would be to try each horse by himself, in the most quiet way. When horses are put on a track in competition with each other, it is difficult, and in some cases impracticable, to fairly settle the question of the rate of speed of which they are relatively capable, on account of the excitement which affects them. The "green horse" from the rural districts, unaccustomed to the strange sights and sounds of such an occasion, cannot act naturally, and stands no chance with the *trained* nag of, perhaps, much less power of speed. Most persons who have witnessed such contests, must have had proof that the race is not always to the swift—that the tricks of jockeys have often more to do with the result than the speed of horses. Certainly, no further argument is needed to show that by trying horses separately, we are much more likely to ascertain their natural style of action and actual rate of speed, than under the confusion and excitement of a general contest.

But it is said the people will not attend purely utilitarian exhibitions. Admitting this to be true, does it justify societies in pandering to a depraved taste, or aiding in the corruption of the public morals? Is it not rather the duty of societies to direct public sentiment,—to educate the people up to correct standards,—to lead them in the way they should go?

Experience, however, shows that the objection is not valid. It has been demonstrated that it is unnecessary to resort to "trials of speed," female (not *lady*) equestrianism, or any other displays of vulgarity or vice, to induce the people to attend agricultural exhibitions. The New York State Agricultural Society, one of the oldest, most useful and influential associations of this character in the country, has from the beginning, steadily refused to tolerate any of these gambling or clap-trap affairs. It has never allowed trials of speed on its grounds, and has never set apart any more ground for horses than was simply required to show their gait. Yet large crowds have always attended the exhibitions of this Society—larger, on the average, than have attended the ex-

hibitions of those societies which have introduced the objectionable displays before alluded to.

The people of our country would hardly be willing to admit that they are inferior in morals or taste, or in a desire for the improvement of the useful arts, to those of Great Britain. But in that country, where agricultural exhibitions have been held for a longer period than they have here, and where they are of late years very numerous, everything that has not a direct bearing on the improvement of agriculture, is rigidly excluded. Yet the people attend in as great numbers in proportion to the population, as they do in this country. I am sorry to be obliged to say, that the visitors to those shows generally study them more closely than our shows are studied by our people. The women of England are admirers of the horse, but they do not give their countenance exclusively to that class in which speed is the chief characteristic. At one of the shows of the Royal Agricultural Society, I saw one of the first ladies of the kingdom, both in position and character, point out to several other ladies of high distinction, the characteristics, in figure and shape, of a massive draught-horse belonging to her husband.

Our Canadian neighbors, who are earnestly devoted to the improvement of agriculture, make exhibitions of a highly creditable character, and which are numerously attended by the people. They have no trials of speed, and allow no private shows to occupy their grounds. Their exhibitions are as well attended as ours. At a late Provincial show of Canada West upwards of a hundred teams engaged in a ploughing-match. Land suitable for so extensive a competition could not be found nearer than six miles distant from the show-grounds; and yet the contest was witnessed by 10,000 people or more. Unusually large premiums were, to be sure, offered on this occasion—the highest being nearly a hundred dollars. But in reference to practical or useful results, who will say that the money was not better expended than it would have been in premiums on "trials of speed" in horses?

It is not reasonable to suppose that our people are naturally so different from those of other countries that they cannot be influenced by similar motives. They need, of course, to have those motives presented to them; and it is only necessary to show in what direction lies their true welfare, to enlist their best feelings and most vigorous efforts.

The subject of trotting and racing horses at agricultural exhibitions, seems at last to be attracting considerable attention from persons who have the prosperity of agricultural societies at heart. W. L. Webber, Esq., in his late address before the Saginaw County Agricultural Society, observed, that "While an agricultural society, conducted as it should be, is productive of manifest good, experience has proved that a society under the name and guise of agriculture, may by mismanagement, and by its officers mistaking or forgetting the objects for which the society is formed, become rather an evil than a blessing to the community."

After stating that the object of the society is to "promote the improvement of agriculture and its kindred arts," Mr. W. proceeds:

"To obtain the greatest benefits from such an association we must not lose sight of the objects stated in the constitution. Let us confine ourselves strictly to those objects. Let us be careful that our annual fairs do not become demoralizing to ourselves and our children, by the introduction of horse-racing, or any other gambling operations under the auspices of the society. Those who desire to risk money on the speed of their favorites, have their associations and race-grounds, where they can pursue their unlawful vocation without intruding their vices upon those who do not desire to witness them. Leave to them the races and gambling incident thereto, while we steadily pursue the objects of our organization.

"By the statute of this State, all *running, trotting or pacing* of horses for any bet or stakes, or *for any reward* to be given to the owner or rider of any animal which shall excel in speed, is declared to be a public and common nuisance, and a misdemeanor, and all parties concerned in them as betters, stake-holders, judges or riders, are guilty of a misdemeanor and subject to a fine of five hundred dollars or one year's imprisonment in the county jail, and the owner who permitted his horse to run such race, forfeits the value of his horse."

It begins to be apparent that the "fast-horse business" is operating injuriously on the interests of agricultural societies. Many of the secretaries of county and district societies in the State, in correspondence with the Secretary of the State Board of Agriculture, mention as a reason for the meagre display of articles and animals in general at the exhibitions of their societies, that the

public interest has been absorbed by the horse-trotting and racing allowed on these occasions. Some say they are convinced that unless this thing is checked, it will ruin the societies. No doubt it has already detracted much from the usefulness of societies, and if persisted in will render them only sources of evil.

The utility of agricultural exhibitions depends very much on the systematic transaction of the business relating to them. There is usually with us too much hurry, and of course confusion, on these occasions. This might be in a great degree avoided, by having the entries made a certain time beforehand. The officers having charge of the exhibition would then know exactly what to provide for. On the plan generally pursued here, it is all guess-work. The Secretary or Superintendent guesses that about so much room will be required for such and such breeds of cattle or sheep; about so many stalls for horses; but he *knows* nothing about it till the animals come on the ground. He cannot then arrange them in proper divisions—the different classes or breeds by themselves, as they ought to be. The space which it was guessed would answer for one breed becomes filled, and the contiguous space is also filled with other classes. More of the first-named come in than had been provided for, and they are of necessity sent off to some unoccupied corner, frequently at a considerable distance from those of the same class that first appeared on the ground. Such cases often occur. They perplex the Superintendent and awarding committees, who sometimes have to spend considerable time in hunting after animals.

All this trouble, as well as great liability to error in the entries, could be saved. It is just as well and even better for competitors to come into the rule of making entries in advance. They can send their lists through the mail, or present them by proxy, and the secretary or his clerk has only to make the entries as he sits quietly in his office, free from the annoyance of a questioning crowd. It is obvious that the business would be much more methodically done in this way, and most of the numerous errors that occur under the present system avoided. It would also put an end to the mean practice sometimes indulged in, of persons coming to the show at the last moment at which entries can be made and looking round to see in what class they would stand the best chance to obtain a premium.

It is advisable, too, that at large shows, at least, the awards be made before the crowd is admitted. Without this it is sometimes

impracticable to make the examinations in a satisfactory manner, and the decisions are more or less wrong. Examples of this are constantly occurring, and they give rise to great dissatisfaction. At all the large English shows the entries are made several weeks in advance, and the awards are made and the prize animals and articles designated by badges or tickets, before the show is opened to the public. Catalogues are printed comprising everything belonging to the exhibition—the number of each entry, the name of the exhibitor, a brief description of the article, and, in reference to animals, their breed, the name of the breeder, and the pedigree. In some instances the prizes are printed in the catalogue; in others a separate catalogue containing the prizes accompanies that of the entries. These catalogues are sold at the gates, and the visitor is at once put in possession of the means of learning everything relating to the show, without the necessity of asking a single question.

The offering of premiums for the settlement of doubtful questions, under proper direction and management, may accomplish much good. It should be a leading object of all associations to do that which cannot be done by individuals. The labor and expense required in conducting experiments is too great for private enterprise, especially when no monopoly of the benefits arising therefrom would be enjoyed. It is manifestly the duty of public institutions like the Michigan State Agricultural College, to engage in experiments relating to agriculture; but agricultural societies might, with great advantage, operate in the same field, and in no way could a portion of their funds be better used.

A committee chosen by a Virginia Agricultural Society, several years ago, to inquire into the subject of premiums for the improvement of agriculture, and to make suggestions in reference to the course to be adopted, made a report, in which, among other sound observations, occurs the following:

"Accurate experiments on any doubtful points, are always valuable to agriculturists in general, but in far the greater number of cases, cause loss to their conductors. Hence the peculiar propriety of encouraging experiments by premiums. An agricultural experimenter may, possibly, by some fortunate discovery, compensate himself for his previous losses; but such good fortune is rare, and most persons who have rendered signal services to farmers, have done so by great individual sacrifices. This great obstacle is not the only one which opposes the correct method of investigation,

and the advancement of the science of agriculture. Notwithstanding the certain attendant loss, every zealous farmer is to some extent an experimenter. But the results of his experiments are not known except to himself, and even to him may appear useless, but which if compared with others, would lead to important consequences.

"To prove by experiment that a doubtful practice is wrong, would be as valuable to agriculture as if the result should show that it is right. But on many such points, proof has perhaps been obtained fifty different times, by as many farmers having no communication with each other, and still the result may be unknown to all but the several experimenters.

"Premiums for experiments conducted with care and accuracy, and repeated under different circumstances until the point in question is clearly settled, could not fail greatly to promote the improvement of agriculture. The advantage derived would not be inconsiderable, even if such premiums had merely the effect of giving publicity to the numerous experiments which are made with other views, and which would otherwise never be known. But we can scarcely doubt that their number could be greatly increased, be directed to the most important objects, and conducted with far more care and attention, when in addition to the hope of being honored with a premium, the experimenter would expect to profit by the labors of many others engaged in similar researches.

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"When in addition to the obstacles already mentioned, to experiments being made by separate individuals urged only by zeal for research, we consider the time and labor, the unremitting attention and perfect accuracy required, the sacrifice is evidently too great to expect from any one unaided farmer. To fix beyond doubt the most inconsiderable fact requires many experiments, to be made on different soils, in different seasons. When results are intended to be compared, the slightest difference in the process may sometimes make a false conclusion appear true. Hence most private experiments are made with so little care as to be scarcely satisfactory to their conductors, and of no value to other persons. Societies, by premiums, may effect whatever in this respect is wanting. They can point out the most important subjects for experiments, require attention to everything which can affect results, and unite the labors of many for a single object."

The reports and experiments would comprise useful matter, and in connection with special papers and essays, of which every society should bring out some annually, would be valuable for publication and distribution. It is much to be regretted that but few agricultural societies bring out much matter that is worth preservation. In many instances this point seems to be wholly overlooked. The parade and excitement of the annual exhibition—and this is too frequently of the objectionable character already spoken of in this article—seems to constitute the principal, if not the only aim. By the course now provided for by law, of the agricultural societies reporting their proceedings annually to the Secretary of the State Board of Agriculture, all matter obtained that is worthy of preservation, is printed by that officer in his annual reports. Each society, however, receives the proper credit for whatever is published—the matter appearing as the doings of the society from which it emanates.

If the officers of agricultural societies would take this matter seriously in hand, they might greatly increase the usefulness of their respective associations, besides adding largely to the fund of valuable information. If it were not for the appearance of invidiousness, societies in the State might be named which present examples of this kind that are worthy of imitation.

[From Report on trials of plows at Utica, 1867; by Hon. JOHN STANTON GOULD.]

OBJECTS TO BE ACCOMPLISHED BY PLOWING.

Before we can judge of the best form and arrangement of the plow, we must first clearly comprehend the objects sought to be accomplished by plowing land.

In general we may say that we seek in plowing land to cause it to yield a greater amount of crops; but this general answer is insufficient for our purpose. We want to know *why* plowing the land makes it more fertile before we are in a position to know which of the various forms of the plow is best adapted to promote the desired fertility.

If we find that two or more forms of the plow are *equally* adapted to improve the condition of the land, the question then arises, which of them can be worked with the greatest economy? This question involves several elements. We are to inquire which of them can be worked with the least expenditure of animal power. It has been proved by the trials instituted by our own Society, by the Highland Society of Scotland, and by the Royal Agricultural Society of England, that some forms of the plow can open a given sized furrow with thirty per cent. less of power than others, or what is nearly the same thing, two horses will do as much as three. It is easy to understand that the farmer using the one will find farming a remunerative occupation, while the farmer that uses the other will carry on his business at a loss. Another question which must be answered under this head of inquiry is, which of the plows will wear the longest? It is well known that there are great differences in this respect, some lasting five times as long as others. The points of many plows now in market will only last for a single day. Again, some plows can be advantageously worked by much less skillful workmen than others, and, of course, unskilled laborers can always be obtained at a lower rate of compensation than the skilled classes. Finally, there are some plows which can be worked with far less labor by the operative, which is an advantage that no good farmer will overlook. The plow which combines with the lowest price the greatest number of these advantages is clearly to be taken as the cheapest plow.

Let us first endeavor to understand how the plow makes land

more fertile. To accomplish this we must know what fertility is, and what causes it.

All plants whatever have their origin in a minute germ whose weight is exceedingly small compared with the weight of the fully developed plant. The germ has no creative power whatever; it can only assimilate other matter with its own substance, and the whole of the extra weight of the matbre plant consists of foreign matter which, by a curious but not unintelligible chemistry, the germ has assimilated with its own tissues and made a part of its substance.

The substances thus assimilated are numerous, varying in different plants, but all derived originally from the rains and dews, from the atmosphere and the soil.

The compounds derived from air and water are called organic; those derived from the soil are called inorganic. Gum, sugar, and woody fibre are examples of the former; lime, potash, iron and saline matters are examples of the latter.

The amount of inorganic matter in plants varies from one to twelve per cent. of their whole weight, according to their different natures; 100 pounds of wheat contains 1.18 pounds of ash or inorganic matter; 100 pounds of rye contains 1.04 pounds; 100 pounds of barley contains 2.35 pounds; 100 pounds of oats contains 2.58 pounds; 100 pounds of wheat straw contains 3.51 pounds of ash; 100 pounds of rye straw contains 2.79 pounds; 100 pounds of barley straw contains 5.24 pounds; 100 pounds of oat straw contains 5.74 pounds.

If we have an acre of land which yields us 1,500 pounds of wheat and 2,000 pounds of straw, it has taken from the soil about eighty-eight pounds of mineral matter.

An acre of land which bears a crop of oats, consisting of one ton of straw and forty bushels of grain, will abstract one hundred and fifty-six pounds of mineral matter from the soil.

The mineral matter absorbed by growing plants does not exist in the soil in unlimited quantities, but in definite quantities that can be exactly ascertained if we resort to the proper methods of inquiry. When we have ascertained the absolute amount of mineral matters required by plants in the soil, if we divide the whole number of pounds of these matters in an acre of soil by eighty-eight, we shall know the exact number of crops of wheat that can be taken from an acre; and if we divide it by one hundred

and fifty-six, we shall know the number of oat crops that can be taken.

When this number of crops has been taken from the soil, it is evident that its capacity for producing wheat or oats is exhausted and can never be restored until the missing mineral is replaced from some foreign source.

In practice, however, the soil becomes incapable of yielding either wheat or oats long before the supply of mineral matter is exhausted. A wheat plant, for instance, may absolutely starve for want of ammonia in a soil which an exact chemical analysis shows to be superabundant in ammonia, or it may perish for lack of phosphate of lime in a soil replete with that substance; or it may be unable to procure a due supply of silicic acid from a soil consisting of pure sand.

Every farmer knows that if, after it appears to be exhausted of its mineral matter, the soil is allowed to rest, exposed to the action of frosts, rains, dews and sun-light, it will, after the lapse of a certain time, recover its fertility; the phosphate of lime, silicic acid and carbonate of potash, in which it seemed utterly deficient, have now been restored to it by the operation of its own internal processes, and not supplied to it from without.

Again, it is found that, on many kinds of land, very small crops are obtained at the first plowing; but that, at every successive plowing, the crop increases. It would seem from this that plants increased in magnitude just in proportion to the diminution of the supply of food.

An attentive examination of these apparent anomalies will lead us to a clear understanding of the causes of fertility in a soil.

First—Soils may contain a superabundance of mineral matters, though they are so unevenly distributed that a larger part of the soil is so deficient in them that it may be absolutely barren. Thus, if we measure off ten square feet at one corner of an acre, and cover it thickly with lime, the opposite corner of the acre receives no benefit from the application; there is too much lime in one plat and none in the other. If the arable surfaces of the two soils are mixed together, both will be benefited and both will be more fertile. Or we may suppose that a soil deficient in phosphate of lime has a bone buried in it. After a certain time it will be found that some of the phosphate of lime and gelatine, with its included nitrogen, is dissolved, and the particles of earth in contact with the bone are saturated with the solution, and

cannot take up any more. If we now remove the bone and bury it in unsaturated earth, another portion will be dissolved, and the soil contiguous to it will be saturated. We may thus, by successive removals and burials of the bone until it is wholly dissolved, render many times more soil fertile than if it had been left steadily in one place. There is no soil known through which the fertile matters are evenly diffused, and hence benefit must always result from mixing together the fertile and unfertile portions.

This is one of the objects sought to be accomplished by plowing land; it is because the spade accomplishes this more perfectly than any form of plow yet known to us, that so much larger crops can be obtained when that method of tillage is used.

Plows differ very widely in their power to mix soils together. Those which invert the furrow completely hardly mix it at all. Those which leave the furrow at an angle of 45 deg. mix it more intimately. Those which take a narrow furrow do it still more completely than those that take a broad one, and those that turn a furrow in two successive portions, as the sod and subsoil plow, intermingle the particles of the soil more perfectly than when it is turned in one mass.

It is obvious, from these considerations, that by bringing into contact with each other the particles of soil which had previously been separated, we increase its fertility, and therefore those kinds of plows which accomplish this object most perfectly, other things being equal, are to receive the preference.

Second—A very little reflection will satisfy a farmer that he may have abundant elements of fertility in his soil, yet he will derive no benefit from them, because they are locked up by affinities which the rootlets of the plant cannot overcome. Thus, one ton of farm yard manure may be spread over a given area of soil, and one ton of coal spread over an equal contiguous area. The plants growing in the soil covered with manure will be abundantly supplied with ammonia, while those growing in the soil covered with the coal will receive none, and cease to grow in consequence. If now we ascertain by analysis the amount of ammonia contained in each, we find that one ton of the former contains 17.4 pounds of ammonia, while a ton of the latter contains 47.6 pounds, or nearly three times as much as the manure contained.

The important practical question, therefore, for the farmer to ask is, not how much plant nutriment is contained in his soil, but

how much is there which is in such a *physical and chemical condition as to be available* by the rootlets of the growing plant.

As the success of the practical farmer depends almost entirely upon a knowledge of these principles, it will be necessary to give a brief explanation of them, especially as it is necessary to comprehend them, if we are to attain to clear understanding of the theory of the plow.

Mr. Way filled several glass vases, furnished with stop-cocks at the bottom, with dry soils of various kinds; he then poured into each of them the drainage water from a barn yard loaded with stercoraceous and saline matters which, after it had filtered through the soils, was drawn off through the stop-cock. That which had passed through the stiffest clay came off limpid and apparently pure, the taste being almost like that of rain water; that which passed through a very sandy soil was but slightly changed in taste or appearance. The power of a soil to absorb the manurial matters seemed to depend upon the relative amount of aluminous matter contained in it, those having the greatest abundance absorbing most, those having the greatest amount of sand having the least. It was, however, established beyond a doubt that *all* soils had a peculiar power of absorbing manurial matters, which could not be separated by the action of water or by any other way than by the absorbent action of the rootlets of a growing plant.

Dr. Vœlcker has followed up these investigations with great assiduity and success. He saturated various kinds of soils with a solution of caustic ammonia, containing 23.24 grains of ammonia to the imperial gallon, and ascertained the amount of ammonia that was absorbed by each kind of soil. He thus found that 3,000 grains of a calcerous clay absorbed 2,758 grains of ammonia from 14,000 grains of the solution. From the same quantity a fertile loamy soil abstracted 2,604 grains; 3,000 grains of a stiff clay soil absorbed 1,262 grains of ammonia; 3,000 grains of a sterile sandy soil retained 3,228 grains of the solution; 3,000 grains of the soil of a rich pasture took up 1,728 grains of ammonia.

He next agitated these soils, which had been saturated with ammonia water of the above mentioned strength, with a solution of ammonia, which was twice as strong as the preceding, and found that they now, curiously enough, absorbed very nearly equal portions of ammonia. Thus, the total amount of ammonia absorbed by 1,000 grains of soil was, in the case of the

1. Calcareous soil,	. . . .	1.5193 grains of ammonia.
2. Fertile loamy soil,	. . . .	1.5363 " "
3. Clay soil,	. . . .	1.1240 " "
4. Sterile sandy soil,	. . . .	1.5220 " "
5. Pasture land,	. . . .	1.5217 " "

Dr. Vœlcker next proceeded to verify these results by repeating the experiments in another form. He made four solutions of ammonia of varying degrees of strength, and used the same soil—a stiff calcareous clay—in all his experiments.

							Per 1,000 grains.
Solution No. 1	contained	44.38	grains	of ammonia	per gallon, or	.	.634
" No. 2	"	21.28	"	"	"	.	.304
" No. 3	"	12.32	"	"	"	.	.176
" No. 4	"	6.16	"	"	"	.	.088

The soil was saturated with each of these solutions, when it was found that 1,000 grains of the soil thus absorbed in

No. 1	. . . . . .	1.32 grains of ammonia.
No. 2	. . . . . .	.64 " "
No. 3	. . . . .	.26 " "
No. 4	. . . . . .	.10 " "

These experiments show conclusively that all soils have the power of absorbing ammonia from its solutions; that no soil can abstract all the ammonia from a solution; that all soils can take up a greater relative amount of ammonia from strong than from weak solutions of ammonia; hence a soil which had absorbed as much ammonia as it would from a weak solution, took up a fresh quantity of ammonia when it was brought into contact with a stronger solution.

Dr. Vœlcker's experiments further showed that soils were equally disposed to appropriate ammonical salts as they were to absorb ammonia itself.

He next endeavored to ascertain how far the soils were disposed to part with the ammonia thus absorbed to the rain water which percolates through them. In order to accomplish this, a quarter of a pound of soil, saturated with ammonia, was well shaken in 7,000 grains of distilled water. It was allowed to settle for three days, when the clear liquor was carefully decanted, and the amount of water contained in it exactly ascertained. The soil thus washed was again shaken in a well stoppered bottle with 7,000 grains of fresh water, and settled and decanted as before. This was repeated seven times successively, with the following results:

First washing, removed by 7,000 grains of water,	.236	grains ammonia.
Second " " " " "	.642	" "
Third " " " " "	.610	" "
Fourth " " " " "	.622	" "
Fifth " " " " "	.120	" "
Sixth " " " " "	.193	" "
Seventh " " " " "	.228	" "
Total	2.651	" "

Thus we see that after seven successive washings with 7,000 grains of water, or 49,000 grains of water in all, only 2.651 grains of ammonia was obtained from a quarter of a pound of soil. It had previously absorbed 4.655 grains of ammonia, and there were therefore 2.004 grains left in it after this very thorough washing.

It is very clear from this experiment that the power of soils to remove ammonia from solutions is much greater than their property of yielding it again to water.

Prof. Way discovered that soils not only possessed the power of separating ammonia, but likewise other bases from their solutions, and they held them after being so absorbed with very great tenacity. Thus, 100 grains of clay soil taken from the plastic clay formation in England, absorbed 1.050 grains of potash from a solution of caustic potash containing one per cent. of the alkali. It is interesting to observe that the liquid was not in this case filtered through the soil, but only left in contact with the cold solution for twelve hours.

Prof. Way has further shown that soils have the ability to separate the alkaline bases from the acids with which they are combined. He found that when saline solutions were slowly filtered through soils five or six inches deep, the liquids which passed through were deprived of their alkaline bases, as potash, soda, ammonia and magnesia, and only the acids were to be found in combination with some other base. Thus when muriate of ammonia was filtered through the soil the ammonia was removed, and a corresponding quantity of lime in combination with muriatic acid was found in the filtered liquid. In the same way sulphate of potash was deprived of its base, and the liquid collected gave sulphate of lime an analysis.

Prof. Liebig has attempted to show that this power of soils which enables them thus to attract manurial substances from their solutions, is analogous to that by which charcoal separates coloring matters and odoriferous matters from their combinations. This is known to be partly mechanical and partly chemical. The chemical

force, like that which causes the solution of substances in water, is very weak; it attracts substances to itself, but does not produce any change whatever upon the character of the substance. The coloring or the odorous matters are held in contact with the pores of the charcoal, just as coloring matters adhere to the fibres of cotton or wool quite unchanged in their nature. Neither powdered pit coal nor the hard, glassy charcoal from sugar or blood have much power to attract coloring matters from their solutions, while *porous* blood or bone charcoal possesses this property in a very high degree, and among wood charcoals, those which have the greatest amount of capillary porosity.

It is just so with soils, those which have the greatest amount of capillary porosity will condense the greatest amount of manurial substances on their internal surfaces; will retain them longest against the adverse solvent action of water, and will give them out most readily to the rootlets of the growing plant. A mass of adhesive clay will absorb but a very slight amount of available manure, but if this same mass is rendered friable by mechanical processes, its power of absorption is amazingly increased. In view of what has been stated, it is very clear that plowing land increases its fertility in one way by increasing its porosity by pulverization.

Again, many manurial substances exist in the soil which, being insoluble, exercise no action on the growth of plants, and contribute nothing to their nutrition; but by the slow, though regular action of the frosts and the rain, the air and the sunshine, these insoluble and refractory compounds are reduced to a soluble state, which are appropriated and held in deposit by the soil to the credit of the next cultivated crop. This routine explains the well known fact that soils, which have been cropped to the very verge of barrenness, will recover their fertility if allowed to remain long enough under the action of these climatic influences to saturate the soil with the necessary plant food which they have unlocked from their chemical combinations and given to the soil in a proper physical condition.

These changes are brought about much more rapidly when certain mechanical changes of condition are wrought upon the soil.

Carbonic acid is one of the most active agents employed in bringing the insoluble inorganic matter in the soil into that physical condition when they become available as plant food; in order that this acid may be formed, it is essential that the carbonaceous matters in the soil should be brought into direct contact with the

atmosphere from which they procure the oxygen necessary to convert them into carbonic acid.

So long as stagnant water remains in the soil, or so long as it is in a dense and very compact condition, it is impossible for the carbon in the soil to be converted into acid.

A supply of available phosphatic salts is essential for the growth of most cereal plants, but these salts often exist in great profusion in the soil without contributing in any way to the nutrition of plants, because they are in an insoluble condition. If now water charged with carbonic acid is allowed to circulate through the hard phosphatic nodules, a portion of them will be dissolved by the acid and diffused by the water among the pores of the soil where they will be fixed in readiness for the demands of the growing plants. In this case we see another way that the fertility of the soil is increased by pulverization, because the air is admitted to the soil, which becomes the agent of converting the carbon existing in it into carbonic acid, which in its turn renders many substances, which were previously useless, very efficient in promoting the growth of plants.

Mr. Way shows that the agents which exercise the greatest power in retaining manurial substances in physical combination with the soil, are the double silicates, which we will endeavor to explain briefly, as their recent investigation has probably prevented a large proportion of the users of the plow from becoming fully acquainted with their properties.

If pure sand or powdered quartz be fused with lime, alumina or some other alkali, they become chemically united, and are known as silicates. Thus, silica combined with potash is called silicate of potash; with ammonia, silicate of alumina, etc. These substances, under favorable circumstances, are very prone to unite together. Thus, silicate of alumina and silicate of lime are often found united together as one well marked substance having definite characters. These new compounds are called double silicates. They have the power, in a remarkable degree, of exchanging bases in a certain prescribed order. Thus, when the double silicate of alumina and soda is digested with a solution of some lime salt, a new compound is formed, in which the soda is replaced by lime; in the same way the lime may be supplanted by magnesia, and the latter by potash.

It is very instructive to observe that these successive replacements take place in a regular and unvarying order, which Prof.

Way has determined as follows: Soda, lime, magnesia, potash, ammonia.

Thus, in the double silicate of alumnina and soda, the soda may be replaced by lime, the lime by magnesia, the magnesia by potash, and the potash by ammonia; but this cannot take place in the reverse order. Ammonia will dispossess any of the articles which precede it on the list; but none of these, either singly or in combination, has the power to dispossess ammonia. The value of these double silicates is in the order in which they are placed above. The double silicate of soda is less valuable than the double silicate of lime; the double silicate of lime is less valuable than the double silicate of magnesia; the double silicate of magnesia is less valuable than the double silicate of potash, and the latter is less valuable than the double silicate of ammonia. Thus we see the admirable provision of Divine Providence, that the more valuable compound shall always have the power of displacing the less valuable, while the inferior is restrained by impassible barriers from supplanting the superior compound.

When we learn that the formation and the transformation of these double silicates from a lower degree into a higher one is greatly promoted by a porous condition of the soil, we see an additional reason for the thorough pulverization of the soil by the plow.

The distance to which the roots of a plant will extend when there is no physical obstruction to their progress through the soil is far greater than is usually supposed by those who have not actually witnessed their extension. We have seen the roots of Indian corn extending seven feet downward; the roots of lucerne will penetrate fifteen feet; onions will run downward three feet where the physical condition of the soil favors the extension of their range. It is obvious that, as the nutritive matters in the soil cannot travel to the root, the latter must therefore go to the former; and the farther the root extends, the greater the amount of food which the plant can obtain, and the greater must be its growth and nutritive capacity. The roots of plants always develop themselves in the direction of least resistance. If the roots of a plant have a hard, impervious soil on their right and a porous soil on their left, the roots will all be directed from the right to the left. The growth of roots takes place by the addition of new cells to their outer extremities. The newly added cell must therefore push the earth before it by a force somewhat greater than the

cohesive force of the soil which it penetrates. The force required for this purpose exhausts the vital force of the plant. A thoroughly porous soil therefore relieves this exhaustion and economizes the vital force which is then directed to some other point. Plants differ greatly in their power of forcing their roots into the soil. Wheat and barley both radicate feebly and will hardly enter a stiff soil, while buckwheat will penetrate it readily. The roots of quack grass (*triticum repens*) will force their way triumphantly through the stiffest clays, while the feebler roots of timothy (*phleum pratense*) will scarcely penetrate them at all.

Jethro Tull, to whom practical husbandry is so much indebted, ascertained the range of porous land required by each kind of plant in the following manner:

In the midst of hard, impervious land he dug a trench twenty yards long, in the form of a truncated wedge, the transverse width of the narrow end being two feet, and the broad end being twelve feet wide. In the fine, loose earth of this trapezoid he planted along the middle line, at distances of one yard apart, the plants whose root range he desired to ascertain. The plant one yard from the narrow end was smaller than that which was two yards from it, and this latter was smaller than that which was three yards distant. When he found the point where the plants ceased to enlarge and remained of the same size until that which was nearest to the widest end, he believed that he had the measure of the normal length of the root of that plant; thus when the trapezoid was planted with turnips each turnip was larger as it receded from the narrow end until the fifteenth, from thence to the twentieth the turnips were of equal size. Measuring laterally from the fifteenth turnip, he found that the range of loose soil was four feet, which he therefore concluded was the natural length of the turnip root.

When the first settlers of Ohio began to cultivate the rich valley of the Scioto, they subjected it to a very imperfect and shallow cultivation; two or three inches was the utmost depth of the plowing, but such was the great natural fertility of the land that the crops of Indian corn averaged seventy bushels to the acre. Successive crops of corn have been annually taken from the soil ever since, but the average product has run down to about forty bushels to the acre. In the year 1862 a large field was plowed with the sod and subsoil plow to the full depth of eight inches.

The result of this experiment was that the land produced one hundred and twenty bushels to the acre, while the skim plowed land contiguous to it yielded but forty bushels.

These facts show an additional answer to the question, "How does plowing increase the fertility of the soil?" They tell us very clearly that it is by affording facilities to the extension of the roots, and thus extending the range of pasture for the plants.

The answers already given by no means exhaust the question. There are still many important uses of plowing which are yet undescribed. The germination of seeds requires seclusion from light; they must therefore be placed beneath the surface. They also require the presence of atmospheric air; without it the radicle will not enter the soil nor the plumule protrude into the air; nor will the starchy matters stored up in the cotyledons be transformed into sugar for the nourishment of the young plant. Pulverization of the soil is therefore essential, that the seeds may be regularly secluded from the light; but in such a way that the air can penetrate very freely to them. These conditions are completely fulfilled when the land is properly plowed.

Stagnant water in the soil, by cutting off the access of air to the roots of plants, prevents their nutrition and consequently their growth. . Deep plowing diminishes this evil by permitting the water to penetrate deeper into the ground.

Warmth of the surface soil is essential to the growth of crops. When water lies upon the surface, it is taken up again into the air by evaporation, which causes the absorption of an immense amount of sensible heat which it renders latent. The cooling of surfaces by evaporation is made practically familiar to us whenever we wash our hands, or wet our heads. Deep plowing and thorough pulverization, by permitting the water to sink into the ground, diminishes the amount of evaporation from the soil, and thus prevents the temperature of the surface from being lowered.

The exhalation of moisture from plants into the air is very great. In the experiments very carefully made by Hales, he found that a sunflower three and a half feet high, with a superficial area of 5.616 square inches, perspired at the rate of from twenty to thirty ounces in twelve hours, or seventeen times more than a man would do under similar circumstances. A vine with twelve square feet of foliage exhaled at the rate of five or six ounces a day. An acre of Indian corn, having 1500 plants on an acre, would exhale about one ton of water in a day. If this moisture is

supplied by the roots from the reservoirs of water in the ground as fast as it is exhaled, no mischief is done; on the contrary, the plant is benefitted by the increased vital action which ensues. If, on the other hand, the supply from the ground is *less* than the amount evaporated, the plant withers and finally dies.

Every farmer is familiar with the curling of the corn leaves when the evaporation is most rapid under the fierce heats and the blue skies of midsummer, especially when the surface is baked hard. He also knows that the true antidote to this condition is a thorough pulverization of the soil. When this is effected, the stores of moisture in the depths of the earth are pumped up by the capillary attraction of the interstices of the soil, and the balance between supply and demand is once more restored.

Soil in a finely divided state radiates heat much more rapidly than when its surface is hard and baked; it will therefore cool more rapidly. Dew is deposited in the clear nights most copiously on those bodies which are relatively colder than the surrounding air. It follows from this, that when two contiguous acres of land are planted with an equal number of corn plants, they will both exhale the same amount of moisture from their leaves; but if the soil of one of the acres is thoroughly pulverized, and the other is hard baked, vastly more of the daily exhalation will be returned to the pulverized soil than to the hard one, on account of its superior radiant powers. The pulverized soil will thus be supplied with water at the expense of the other.

No soil can produce maximum crops of any kind where the food of the desired kind of plant is taken up and appropriated by weeds. It is therefore one of the prime objects of agriculture to destroy them, and at the same time to utilitize them so as to make them restore to the desired plant that nutriment of which they have already robbed it. Other things being equal, that plow is best which most completely buries the weeds growing on the surface and secures their decomposition, so that the roots of the growing plant can avail themselves of the food stowed away in the cells of the weeds.

We have now completed the task we proposed to ourselves, by showing all the objects which it is proposed to accomplish by the use of the plow in order that we may be enabled to ascertain what form of the plow is most likely to secure the ends which we have in view. They are:

First—To pulverize the soil with a view to promote those chem-

ical transformations which will unlock the food of plants from its combinations with unassimilable elements and put it into such a physical condition as will make it accessible to the rootlets of the plant.

Second—To pulverize it with a view to facilitate the formation of the double silicates.

Third—That the roots may freely permeate the soil in all directions, thus increasing the range of their pasture.

Fourth—To promote the germination of seeds.

Fifth—To get clear of stagnant water from the surface.

Sixth—To prevent the refrigeration of the soil by evaporation.

Seventh—To secure the return of the water evaporated by the plant in the form of dew.

Eighth—To destroy the weeds in the soil.

Ninth—To utilitize them and convert them into food for plants.

All plows known to us press downward upon the subsoil with a weight proportioned to the depth of the furrow slice and the density. This downward action combined with the sliding action of the shares has a necessary tendency to pack the subsoil and to polish the surface. This effect is cumulative, and every successive plowing increases the evil until the bottom of the furrow becomes so dense that neither rain nor air nor the roots of plants can possibly penetrate beneath it. The spade avoids this difficulty. Hence, other things being equal, a plow which leaves the bottom of the furrow in the same state in which the spade leaves it would have a very decided preference.

We have not sought to give a complete and exhaustive enumeration of all the objects which the plow is designed to accomplish, such as the mellowing of the soil by frost and the destruction of insects, but only those which involve the peculiar form of the plow and the principles of its construction.

[From the Farmers' Magazine, (British).]

PRINCIPLES OF HAY MAKING.

THE CHANGES WHICH TAKE PLACE IN THE FIELD AND IN THE STACK.

BY DR. AUGUSTUS VOELCKER.

If grass or clover could be made into hay without undergoing any change in composition, the hay, when made, would no doubt be found as valuable as the green food from which it was derived. From exposure to the broiling heat of the sun on a hot summer's day, cut grass or clover hardly lose anything else but water, neither do their constituents undergo material alterations if the grass is not much bruised, and the drying process takes place with sufficient rapidity. The green color, sweet taste, and aromatic smell of well made hay, plainly show that such is the case, and that hay making is not always or necessarily attended with loss of nutritive matter. I am aware, however, that many practical men maintain the opinion that grasses and clover are less nutritious as hay, than when consumed green; though this may be true as a matter of fact in nine cases out of ten, I conceive this is not a matter of necessity, but, if it were always practicable to resort to artificial means of dessication, or to have under complete control the natural drying process in the field, no material loss would be experienced; the green color of the grass would be preserved, nothing but water would escape, and all the solid constituents remain behind, in much the same state of combination in which they occur in the succulent produce of our grass fields.

No attempt has been made as yet to apply artificial drying processes to hay-making on a large scale, and I question much whether in ordinary farm practice, it is worth while seriously to entertain suggestions for drying grass by artificial heat, dry currents of air, or the combined action of these two agents. The special question whether sewage grass grown in the immediate neighborhood of large towns, can be profitably made into hay by artificial means, remains yet to be solved. In ordinary farm practice hay-making, in a trying season, will probably always be subject to more or less of waste in feeding substances; it becomes us, therefore, to inquire how far the loss can be mitigated, if not avoided. To this end it will be useful to trace somewhat in detail, the nature and

extent of the injury which grass sustains in hay-making, since hitherto little has been done, in this direction. Such losses are generally traceable:

1. To prolonged showery weather after the grass has been cut, so that it ultimately gets wet and half-dried, and has to be moved frequently on the ground before it can be carted and stacked.

2. To bad management in the field and subsequent heating in the stack.

3. To the mistake of cutting the produce too early or too late in the season.

Prognostications of the weather are, to say the least of them, very deceptive, and though the sun may be shining when the grass is cut, predictions as to the continuance of fine weather cannot be relied upon. Over one great cause of the loss, the farmer then has little or no control; it is not so, however, with the two remaining causes; though it is to be feared that injuries thus done to hay are too frequently put down altogether to bad weather.

I.—UNPROPITIOUS WEATHER DURING THE HAY-MAKING SEASON.

Grass and clover, when ready to be cut down, contain a considerable quantity of sugar, gum, mucilage, albuminous, and other soluble compounds, which are all liable to be washed away by heavy showers of rain. As long as grass is still quite fresh, rain falling upon it has little or no injurious effect, for, fortunately, a coating of waxy or fatty matter covers the epidermis, and wraps, so to speak, the whole vegetable matter in a water-proof mantle. Rain for this reason may fall for days on newly-cut grass, without doing any injury to it; but the case is very different, if by repeated turnings, the crop has become more or less bruised, and rain then descends on the half-made hay; not only are sugar, gum, and other soluble matters then liable to be washed out, but the bruised state of the plants, admitting at least a partial diffusion of the various constituents through the lacerated cell-walls, induces fermentation, which if not checked at once, causes further loss. During fermentation, soluble albumen and sugar are destroyed—two of the most valuable elements of nutrition. In showery weather, grass recently cut should for this reason not be turned over more than is absolutely necessary, and under all circumstances it is desirable to handle the crop as lightly as possible, in order that it may not get much bruised. That the loss in our hay crop, under these circumstances, is at times great, scarcely admits

of a doubt, and it is to be regretted that there are no experiments on record which exhibit in figures their exact amount. Instead of analytical results, I am able, however, to give a practical illustration from the use of some clover hay, which was made in very wet weather, in some experiments tried upon sheep. With a view of ascertaining the practical feeding value of several articles of food, I supplied weighed quantities of different foods to six pens of Cotswold sheep, each containing four animals. To one of the pens nothing but this clover hay cut into chaff was given. When first put up for experiment, on the 9th of November, the four sheep weighed respectively:

	Lbs.
No. 1,	96
" 2,	101
" 3,	99½
" 4,	93
Together,	389½

During the first fortnight each sheep received 1½ lbs. of clover hay chaff per day, and care was also taken to provide fresh water.

At the end of the fortnight the four sheep were put on the weigh-bridge and then weighed:

	Lbs.
No. 1,	95
" 2,	100
" 3,	98½
" 4,	91½
Together,	385

Finding that all four sheep had lost in weight, I gave them during the next fortnight, 2 lbs. each, per day. On the 7th of December they weighed:

	Lbs.
No. 1,	94
" 2,	101
" 3,	98
" 4,	88
Together,	381

Thus, notwithstanding the larger amount of food, the sheep had lost, together, 4 lbs., since the last weighing.

Knowing that the clover hay was made in wet weather, and long on the ground before it was carted and stacked, and having experimentally found a fair allowance insufficient to support the live weight of one sheep, I next gave them as much of the same hay as they would eat, and instead of cutting the clover into chaff as before, supplied it as taken from the stack. The food not con-

sumed was weighed back each day, and found to consist mainly of the harder and less palatable stems of clover. From the 8th of December to the 14th, the four sheep ate 78½ lbs. of clover; in the next week, 79 lbs., and in the next, 76 lbs., then 78½ lbs.; from the 4th of January to the 11th, inclusive, they consumed 74 lbs., and in the following week, 64½ lbs.; then again 73½ lbs., then 63½ lbs., and in the last experimental fortnight, 76½ lbs. in one week, and 63 lbs. in the last.

The periodical weighings of the four sheep are incorporated in the following table:

SHEEP.	When put up for Experiment.						Loss, –. Gain, †.
	Nov. 9.	Dec. 21.	Jan. 4.	Jan. 18.	Feb. 1.	Feb. 15.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
No. 1,	96	95	93	94½	95	96	
No. 2,	101	100	100	102½	105	105	†4
No. 3,	99½	98	98	98½	100	99	–0½
No. 4,	93	89	85½	85½	87	87½	–5½
	389½	382	376½	381	387½	387½	Total, –2

This experiment is interesting in two ways. It shows, first, the folly of supplying animals with bad hay alone, and proves, secondly, that clover hay can get deteriorated by rain, long keeping and frequent turnings in the field, to such an extent that any amount which sheep will consume is barely sufficient to maintain their original weight. Messrs. Lawes and Gilbert have shown that sheep fed upon well-made hay alone increase in weight. The experiment, it will be seen, was continued for a period of more than three months, and the weighings done by myself in person. These practical results illustrate more forcibly the serious injury to which clover is subject when made into hay under an unfavorable season, than any analytical data can possibly do. Having, however, made a practical analysis of the clover, I may as well point out its general composition.

COMPOSITION OF CLOVER HAY INJURED BY RAIN AND BADLY MADE.

		Dried at 212° Fahr.
Moisture,	20.45	
*Nitrogenous organic matter,	8.50	10.69
Non-nitrogenous substances,	64.27	80.79
Mineral matter, (ash,)	6.78	8.52
	100.00	100.00
*Containing nitrogen,	1.36	1.71

I regret that I did not determine at the time the percentage of woody fibre, nor the amount of matters soluble in water. However, the comparison of the preceding analysis with that of well-made clover hay, sufficiently indicates the very inferior character of the clover employed in the feeding experiments.

On an average good clover hay contains:

Moisture,	16.60
*Nitrogenous substances,	15.81
Non-nitrogenous substances,	60.00
Mineral matter, (ash,)	7.59
	100.00
*Containing nitrogen,	2.52

Although the percentage of nitrogen in food does not afford invariably the means of determining with anything like accuracy, its relative feeding value, in the case of clover hay a very low percentage of nitrogen always indicates inferior quality, for as the leaves and more succulent portions of clover are much richer in nitrogen than its hard stems, a small percentage of nitrogen shows that the more delicate, brittle, and more nutritious leaves have been wasted to a great extent, in the process of hay making. Compared with good clover hay, the injured sample contained little more than half the amount of nitrogenous or flesh-forming matters, and was no doubt rich in indigestible woody fibre.

II.—LOSS BY BAD MANAGEMENT IN THE FIELD, AND SUBSEQUENT FERMENTATION IN THE STACK.

Although hay making is a simple operation, yet experience and judgment are required to decide when to cut the grass, when to handle and when to stack the hay. I have seen farmers spending labor in turning hay on overcast days, on which a dew-point hygrometer showed the air to be nearly saturated with moisture, proving that evaporation could not possibly take place at the time, and rain might be expected at any moment. In such a state of the atmosphere it is not only useless, but positively injurious, to knock about half-made hay, for it tends to bruise it and to render it more liable to be attacked by the rain of which the barometer, or more decidedly the hygrometer, has given previous warning. Frequent turnings of half-made hay should be avoided, especially in the case of clover, when the finer and more nutritious parts—the heads and small leaves—are particularly liable to be knocked off by clumsy handling.

It is further well known that hay, when badly made in the field, loses subsequently in the stack both in weight and in quality; but the nature of the changes it undergoes when it heats or ferments in the stack are not so well understood; it may, therefore, not be amiss to describe them as briefly as possible. Let me direct attention to a second analysis of good clover or meadow hay, drawn up more in detail by Professor Way:

AVERAGE COMPOSITION OF CLOVER HAY.

		Dried at 212° Fahr.
Moisture,	16.60	
Fatty matters,	3.18	3.18
*Albumen and similar nitrogenous compounds, (flesh-forming matters,)	15.81	18.96
Gum, sugar, mucilage and carbon-hydrates, readily convertible into sugar,	34.42	41.27
Indigestible woody fibre, (cellulose,)	22.47	26.95
Mineral matter (ash,)	7.52	9.01
	100.00	100.00
*Containing nitrogen,	2.53	3.03

The preceding analysis represents the average of 75 analyses of clover, and a few other plants which are usually found amongst clover seeds. Since varieties differ much amongst themselves, corresponding differences in composition must be looked for in clover hay, according as one species or another prevailed in the field in which it grew; the time of cutting will also much affect the result. The above figures, therefore, admit only a *general* application. Clover hay generally absorbs and retains a little more water than common meadow hay under the same circumstances, and when in good condition contains more sugar, gum, and analogous compounds than meadow hay, from which it is chiefly distinguished by a much larger proportion of nitrogenous or flesh-forming matters.

Taking the mean of twenty-five analyses of common meadow hay, we obtain the following:

AVERAGE COMPOSITION OF MEADOW HAY.

		Dried at 212° Fahr.
Moisture,	14.61	
Wax and fatty matters,	2.56	2.99
* Albumen and other nitrogeneous compounds, (flesh-forming matters,)	8.44	9.88
Sugar, gum, starch and similar compounds, (respiratory substances,)	41.07	48.09
Indigestible woody-fibre, (cellulose,)	27.16	31.80
Mineral matter, (ash,)	6.16	7.24
	100.00	100.00
* Containing nitrogen,	1.35	1.58

Hay, whether produced from clover or natural grasses, evidently contains a good deal of ready-formed sugar or soluble organic matter, having an analogous composition, and readily convertible under the influence of ferments, first into sugar, and afterwards into alcohol and carbonic acid. These constituents are essential elements in all liquids and moist substances capable of entering into fermentation. No less essential are albumen, gluten and other nitrogeneous compounds. Some of the nitrogeneous matter in hay occurs in a soluble, some in a condition insoluble in water. Soluble albumen and all albuminous compounds exposed for a short time to air and moisture, are readily transformed into ferments; that is to say, agents that play the same part as yeast in setting up fermentation in sugary compounds. It appears that when a vegetable juice ferments, the admission of the air is necessary to the commencement of the change which then goes on, even if the air be afterwards excluded. Ferments almost invariably contain the germs of minute fungi, which become rapidly developed and multiplied in the measure in which the fermentation proceeds. Albuminous compounds that have been exposed for a short time to the influence of the air, as in ordinary ferments, are only capable of acting as inducers of fermentation when in a state of decomposition. This explains satisfactorily why hay that has been subject to excessive fermentation generally is very innutritious, such a great loss of flesh-forming, as well as sugary constituents, being implied by fermentation.

The most reasonable explanation of the fermentation of sugar has been given by Liebig. Ferments, the great German chemist says, being in a state of decomposition, have their constituent particles in a state of motion, and by communicating, mechanically, on impulse or motion to the particles of sugar, destroy the balance of affinities, to which its existence is owing, and thus give rise to a new balance or equilibrium more stable under existing circumstances. The elementary particles of the sugar being disturbed in their previous arrangement, group themselves according to their individual affinities; and while the carbon forms on one side a compound containing all the hydrogen (alcohol) it yields, on the other a compound containing the greater part of the oxygen (carbonic acid).

Alcoholic or vinous fermentation may thus be briefly described as the breaking up of sugar under the influence of ferments, and

the reconstruction of constituent elements of sugar into alcohol and carbonic acid.

Another condition favorable to fermentation is an elevated temperature. If the thermometer ranges from 65° to 80° Fahr., fermentation proceeds with rapidity, whilst at a lower temperature it goes on more slowly, and is stopped altogether at 32° Fahr.

In the absence of a sufficient amount of water, many substances otherwise capable of entering into fermentation, remain apparently unaltered for a long period. Too much or too little water is alike unfavorable to the process. If one part of sugar is dissolved in three or four parts of water, and yeast is added, and the sugary liquid then placed in a warm room, no fermentation takes place, although three of the essential conditions have been fulfilled. Such a solution will require to be diluted with about an equal weight of water, in order to set up active fermentation. On the other hand, sugar dissolved in, say 16 to 20 parts of water, after the addition of yeast, either ferments but very slowly, or rapidly turns acid in a warm place.

These facts have a direct bearing on the proper conservation of hay. As long as grass and clover are still quite fresh, the proportions of water to that of sugar in the green plant, are too large to encourage fermentation; the nitrogenous constituents in newly-cut grass, moreover, only become ferments after the vitality of the plant has been destroyed, and the vegetable cells and vessels have become ruptured by partial drying, and their contents have been mingled together.

With the evaporation of water, and to a certain extent the more or less complete destruction of the living organization of the plant, the conditions become more favorable for active fermentation. By degrees the drying crop arrives at a stage when the relative proportion of sugar and of the remaining moisture are most conducive to fermentation. Should the weather unfortunately turn showery at that stage of the hay-making process, and the air become saturated for many days and weeks together, the half-made hay begins to ferment already in the field. When this takes place the hay loses in quality, and becomes much more liable to heat afterwards in the stack. If, on the contrary, fine and warm weather sets in, and evaporation proceeds with rapidity, the percentage of moisture soon sinks sufficiently low to prevent altogether, or greatly to retard fermentation. The hay remains sweet, and shows far less tendency to heat in the stack, even if it actually

contains more moisture, than hay made in unfavorable weather. The more quickly hay can be made in the field, and the less it gets bruised or loses color there, the less likely it is to heat in the stack. However, much hay is injured when it is quickly made, and in a fine season; it looks to be ready before it is so.

HEATING IN THE STACK.

If dried ever so carefully in the field, hay, nevertheless, heats to some extent in the stack. A slight fermentation so far from being injurious, may be useful, for as is well known, peculiar aromatic principles are thus generated, which certainly renders hay more palatable, and it may be, more nutritious. As long as the green color is retained there is no danger of the hay losing in quality, but if the heat in the stack becomes so intense and continuous as to turn the hay decidedly brown, I have no hesitation in saying that considerable loss in feeding matter is incurred.

Some feeders of stock prefer brown hay to green, and it cannot be denied that the former often has a more aromatic smell and a more savory taste than the latter. Although brown hay is much relished by stock, I do not think it desirable to put up hay so wet that it will afterwards turn brown in the stack; for, as I shall show presently, the sugar that is wasted when hay heats and turns brown in the stack, appears to me of greater value than the aromatic savory substances which are generated by that process.

Some years ago I had an opportunity of examining brown hay which had a peculiarly aromatic, quite fruity flavor. It tasted decidedly acid, and contained scarcely any sugar, but a good deal of mucilege, soluble brown humus-like compounds, with but a small proportion of soluble albuminous matters. On further examination, I found the acid in the hay to be acetic acid. The hay was very brittle, dark brown, and an analysis gave the following results:

COMPOSITION OF BROWN, STRONGLY-FERMENTED HAY.

General Composition.

		Dried at 212° Fahr.
Moisture,	18.33	
Soluble organic matters,	14.81	18.13
Soluble mineral matters,	3.98	4.87
Insoluble organic substances,	60.29	73.82
Insoluble mineral substances,	2.59	3.18
	100.00	100.00

Detailed Composition.

		Dried at 212° Fahr.
Moisture,	18.33	
Fatty matters,	1.70	2.08
*Soluble albuminous compounds,	1.94	2.37
Mucilege, gum, brown extractive matters and traces of sugar,	9.24	11.31
Acetic acid,	1.93	2.36
Digestible fibre,	23.01	28.19
†Insoluble albuminous compounds,	8.75	10.71
Indigestible woody fibre (cellulose),	28.53	34.93
Soluble mineral substances,	3.98	4.87
Insoluble mineral substances,	2 59	3.18
	100.00	100.00
*Containing nitrogen,	.31	.38
†Containing nitrogen,	1.40	1.71

The occurrence of a considerable amount of acetic acid in this hay, and the all but complete absence of sugar, deserve a special notice. Vinegar manufacturers are well acquainted with the fact that all sugary substances may be employed for the production of *vinegar*, and that in the so-called rapid vinegar process a dilute alcoholic liquid in the presence of a porous substance, such as wood shavings or chopped straw, or under the influence of a ferment, is rapidly transformed into vinegar. Scientific chemists, moreover, have pointed out the relation which exists on the one hand between sugar and alcohol, and on the other between alcohol and acetic acid—the acid of vinegar—showing that the latter is formed by the absorption of oxygen; in other words that acetic acid results from the oxydation of dilute alcohol. It is clear, therefore, that the acetic acid found in the heavier hay was produced at the expense of the sugar present in unfermented or only slightly fermented hay.

Subsequently I had an opportunity of examining a rick of clover hay, which became so hot in the interior that it had to be disturbed. It had been made in a bad season and was stacked when too moist. On removing the top-layers of the rick the vapors emanating from the heated hay were found to have a peculiar pungent irritating odor, which particularly affected the eyes. A chemist could not doubt for a moment that these irritating vapors were due to the volatile inflammable compound which has received the name of Aldehyd. The same pungent odor may be noticed in vinegar manufactories at a certain stage of the vinegar-process, and it is well known that aldehyd is produced in abundance when weak alcoholic liquids are allowed to trickle slowly over wood-shavings kept loosely in perforated capacious vats freely admitting

air. In this operation a large surface is exposed to the air, and the alcohol transformed into aldehyd by oxydation. Alcohol consists of four equivalents of carbon, six of hydrogen, and two of oxygen, its composition consequently may be expressed by the formula $C_4\ H_6\ O_2$. By taking up two equivalents of oxygen from the air alcohol becomes changed into aldehyd, with the production of two equivalents of water. This simple change may be represented as follows:

$$\overbrace{C_4\ H_6\ O_2}^{\text{Alcohol.}} \times \overbrace{{}_2O}^{\substack{\text{Oxygen}\\ \text{from the air.}}} = \overbrace{C_4\ H_4\ O_2}^{\text{Aldehyd.}} \times \overbrace{{}_2H\ O}^{\text{Water.}}$$

Aldehyd thus differs from alcohol by containing two equivalents less of hydrogen. The principal interest with which aldehyd is invested, arises from the facility with which it absorbs oxygen, in consequence of which it is readily transformed into acetic acid. The addition of two equivalents of oxygen to aldehyd is all that is required for this change, as will be seen from the following formula:

$$\overbrace{C_4\ H_4\ O_2}^{\text{Aldehyd.}} \times \overbrace{{}_2O}^{\text{Oxygen.}} = \overbrace{H\ O,\ C_4\ H_3\ O_3}^{\text{Acetic Acid.}}$$

This oxydation of aldehyd is accompanied with the evolution of much heat. If the supply of air be insufficient, the acidification of dilute alcoholic liquids or substances capable of entering into alcoholic fermentation, may become so imperfect that the alcohol is merely changed into aldehyd—a product intermediate between alcohol and acetic acid; and as adelhyd is an extremely volatile substance, it may escape without becoming further oxydized into acetic acid. In the interior of a closely-packed hay-rick in an active state of fermentation, in which the sugar is first converted into alcohol and carbonic acid, the supply of air is necessarily but limited, and hence it happened in the case before us, that although the vapors of aldehyd emanating from the clover hay-rick were so overpowering as to render it unsafe for a man to stand on the rick, yet so little acetic acid was formed in the hay that I did not consider it worth while to determine the amount quantitatively.

My observations on the changes which badly-made hay undergoes in the stack, show clearly that excessive fermentation destroys sugar, one of the most valuable constituents of hay, which passing first into alcoholic fermentation is finally lost, either in the shape of aldehyd or that of acetic acid according as the supply of air is more or less copious.

A glance at the following table will show that the hay, as containing 38 per cent. of water, was far too wet for stacking:

COMPOSITION OF STRONGLY-FERMENTED CLOVER HAY.

General Composition.

		Dried at 212° Fahr.
Moisture,	38.22	
Soluble organic matters,	9.40	15.17
Soluble mineral matters,	3.06	6.39
Soluble organic substances,	46.01	74.23
Insoluble mineral substances,	2.61	4.21
	100.00	100.00

Detailed Composition.

Water,	38.02	
Fatty matters,	.90	1.45
*Soluble albuminous compounds,	1.88	3.03
Gum, mucilage, brown extractive matters and a little sugar,	6.63	10.69
Digestible fibre,	15.55	25.09
†Insoluble albuminous compounds,	8.12	13.11
Indigestible woody fibre (cellulose),	22 33	36.03
Soluble mineral matter,	3.96	6.39
Insoluble mineral matter,	2.61	4.21
	100.00	100.00
*Containing nitrogen,	.30	.48
†Containing nitrogen,	1.30	2.09

Apart from the large excess of water, the high percentage of indigestible woody fiber shows that this sample was of very inferior quality, and that the excessive fermentation to which it was subject in the rick, destroyed much sugar, as well as albuminous compounds. Bad as this hay was, it was by no means at its worst, for on keeping in the stack it became reduced by degrees to a dark brown mass which crumbled under the fingers like snuff, and became only fit for the dung-hill.

It is well, therefore, to remember that highly-fermented hay, which has passed through the acetous acid fermentation, on prolonged keeping in the rick undergoes a kind of slow combustion or eremacausis, in consequence of which compounds like those present in peat are formed, and much valuable feeding matter is entirely resolved into gaseous products.—*Journal of the Royal Agricultural Society.*

The remainder of Dr. Voelcker's valuable paper, is devoted to the subject of

LOSS ON CUTTING GRASS AND CLOVER EITHER TOO EARLY OR TOO LATE IN THE SEASON.

In considering this subject, Dr. V. brings forward the results of a series of experiments made by himself at the Cirencester Agricultural College. He divided a field of clover of even growth into twelve plots containing one square rod each. Some of these plots were mowed five times in the course of three and a-half months—the first cutting being on the 15th of April, and the last on the 28th of July. The clover at the different cuttings was weighed and analyzed, and the results are given in elaborate tables.

Dr. V. states that his object in commencing to mow the clover at the time mentioned, was to ascertain whether the eating off young clover early in the spring, as is sometimes the practice when food is scarce, was attended with loss in food or not. Except for this object there would have been no use in mowing clover so early in the season.

Without attempting to give in detail the results obtained by these experiments, it may be stated it was found that the percentage of nutritive matter in clover was least in its earliest growth, that this percentage gradually increased till the plants burst into flower, at which stage the amount of nutritive matter remained nearly stationary for a few days, and that it afterwards rapidly diminished—the results thus strikingly agreeing with practical observation.

An important fact brought out by the experiments is, that a much greater amount of solid food was obtained from one cutting of clover that was cut at the flowering stage, than from the same extent of land on which the clover was previously cut several times, and therefore not allowed to reach the flowering stage. The following extract is interesting in reference to this point, and as showing important changes in the clover plant at a particular stage of growth:

"During the fortnight which elapsed between the 12th and 26th of May, the clover appeared to come rapidly to perfection; it was then in full flower and looked remarkably vigorous. In this period the assimilation of carbon through the medium of the leaves or roots appears to be very great, for whilst sugar and other carbon-hydrates are at this time abundantly produced, little or no further accumulation of nitrogenous substances appears to take place.

In the case before us the two mowings on plot 3, contained exactly as much nitrogen as the one mowing on plot 4. Calculated per acre, we find in the clover of the 12th of May, 72 lbs. of nitrogen, and in the second mowing on the 26th of May, 3.2 of nitrogen, or 75.2 lbs. in all—the identical quantity of nitrogen which is contained in the much larger weight of clover obtained on plot 4, by cutting it only once, on the 26th of May. At this stage, as it seems, much carbon is assimilated by the plant for the production of sugar and other carbon-hydrates, which are serviceable in the animal economy for the production of fat; whilst the nitrogenous substances previously taken up are diffused, and probably undergo greater elaboration. In both these respects the clover becomes more nutritious and valuable at this time in spite of its percentage in nitrogen being smaller.

"Indeed, *within certain limits*, we may say that the amount of nitrogen in clover diminishes in the measure in which its nutritive value increases. We must, however, be careful how we apply this rule, for a small percentage of nitrogen may indicate alike the presence of much or little sugar. In succulent, sweet-tasting, and really nutritious clover this percentage is small, comparatively speaking, because the nitrogenous or albuminous compounds in the plant are diffused through a large mass of carbon-hydrates or fat-producers, and in over-ripe, woody, insipid, and innutritious clover the percentage of nitrogen also is small, because such clover contains little sugar and much indigestible woody fibre or cellulose, which is non-nitrogenous substance."

Commenting on other points connected with his investigations, Dr. V. observes: "There is positive evidence that at the period when clover bursts into flower, the assimilation of nitrogenous constituents appear to come to a stand-still, whilst that of carbon-hydrates is proceeding with greatly accelerated speed."

In reference to the loss which clover sustains in weight and quality when it is allowed to stand after it has arrived at perfection, Dr. V. gives some interesting facts showing the diminution of nitrogenous matters from week to week, as the clover was cut. "On the 16th of June we found 11.31 in the dry produce; on the 23d only 9.31; in the week following 8.25; and this sinks to 7.94 in another week, and on the 18th of July we get only 6.62 per cent., and ten days afterwards 6.06 per cent. of nitrogenous matter in the dry clover hay. We have here a steady decrease of the percentage of nitrogen in the dry produce at each experimental

period from the 16th of June to the 28th of July. Thus the perfectly dried clover hay contained—

	Per cent. of Nitrogen.
On the 16th of June,	1.81
" 23d "	1.49
" 30th "	1.32
" 7th of July,	1.27
" 18th "	1.06
" 28th "	.97

"This loss in nitrogenous matter appears to me to be chiefly due to the comparatively small proportion of fine green leaves, and greater abundance of woody matter which is found in over-ripe clover hay. At the same time I do not think the loss is due entirely to this cause, and the whole subject is well worthy a special investigation. It is extremely difficult to trace with precision the changes which nitrogenous matters undergo in the living plant, to determine their influence in the assimilation of atmospheric plant-food, or to account for their accumulation in plants at certain stages of their growth, and their diminution at others."

[From Report Connecticut Board of Agriculture.]

ON THE "DISEASES OF PLANTS CAUSED BY FUNGI."

TWO LECTURES BY PROF. W. H. BREWER OF SHEFFIELD SCIENTIFIC SCHOOL.

You are all familiar with the ordinary phenomena of vegetable growth. That the ordinary plants seen are green, that they derive their nourishment from the soil and air, that the water is drank in from the soil, bringing with it in solution various needed substances, that air is breathed in by the leaves, and that under the influence of the light and heat of the sun the elements of the food are elaborated and assimilated. You all know that the beginning of such plants, is in a seed.

In the seed of an ordinary squash, or bean, we find the rudiments of a new plant, an embrayo, the rudimentary root and leaves. If we place this seed in a moist soil, with the right conditions of moisture and warmth, it swells, the germ begins to grow, goes through its course, first the leaves, then the flowers, then the seeds which in turn contain the embryos of future plants of the same kind.

Now, such plants are infested with others which live upon them, of entirely different structure and nature, parasitic plants, which suck their juices, change their substance, or injure them in one way or another, producing some of the well known *diseases* of plants, for plants, like animals, are afflicted with diseases.

The farmer can easily study the growth and structure of the ordinary plants he cultivates, but not so with these minuter forms that are parasitic upon them. These are mostly microscopic in size, and require expensive and powerful microscopes for their study, and moreover much time, but during the last few years, naturalists have devoted much time to them, and I propose in these two lectures to give you some of the conclusions arrived at by scientific students in this vast field, that farmers may turn these labors to their profit and advantage. For the modern farmer must turn to his account all the aids that modern science can give.

You are all aware that plants are composed of *cells*, and not only plants, but all living beings, no matter how large or how

small. And let us not confound the cells of plants with the larger pores we see so easily with the naked eye. These are sap vessels, or channels for the juices of the plants, or for air, but not the ultimate cells, which are generally too small to be seen with the naked eye. The pores are generally tubes, or channels, surrounded by the cells, which are built up around them. The cells are always closed sacs, little bags, as it were. They may be round, or elongated, or very long like tubes, closed at both ends, or angular, or almost any shape, but they are at first always closed. If they begin round, if they are very numerous, they press against each other, and thus flatten each others sides. These little sacs are hollow, and have two or more coats or walls, lying close together so as to appear as but one, the inner being the thinnest, and lying close against the outer. It is as if we had a bag of coarse cloth, lined with cloth of a finer fabric.

During growth, these cells or sacs are filled with fluid, the sap of the plants, and with little grains floating in it. The fluid passes easily through the walls, although we can see no openings, as water will pass through ordinary cloth.

As the plants grow, the growing, living cells increase, somewhat in size, then divide, an old cell making two or more new ones. In this way all living beings increase in size, the fluids circulating through their walls, and by contact with them are changed in their chemical composition, by some mysterious process.

In most cells, the growth takes place by the cell growing larger, then the inner wall at some point separates from the outer on the opposite sides, and projects inwards, and finally forms a partition through the cell, thus making two, or it may be more. We must continually bear in mind, that they continue closed during the earlier periods of growth, and that the fluids circulate through the walls, although the best microscopes cannot show any holes in them, and thus the chemical changes in the plant go on in contact with the living walls, or in their cavities. In some plants starch, oil, and other products, are thus produced within this little closed prison.

Dead chemical substances, in contact with these living cells, may form compounds that cannot be produced in any other way. It is in them that the so-called *Vital Principle*, or *Vital Force*, dwells, that mysterious power which has had such a variety of names bestowed upon it, but of which we as yet know so little,

but which we know is essential to the growth of living things, and the production of the myriad organic compounds which are formed in the living plant or animal.

Now, as I have said, the beginning of a new plant is the embryo in the seed, but the beginning of the embryo is a single cell. The life of the plant begins with the seed, the life of the seed begins with a single cell within the proper organs of the parent plant; that is, of the higher plants, those with which you are familiar.

But there is a great class of plants which have no *seeds* in the sense in which I have used that word, but whose growth begins directly from a single cell, of peculiar structure, which we call a *spore*, and the plants produced we call *flowerless plants*, as they produce neither flowers nor seeds. They vary greatly in their size and characters, some are large, many are microscopic, while some consist of but a single cell.

The green coating that we see on our brick walls and pavements in wet weather, the red snow of the arctic regions, are composed of these simple plants, in which a single cell may constitute an entire plant. They may never go farther in their growth than one cell; this increases and divides into other cells, each of which is a new plant. These may dry up and be blown away by the wind, to revive again when they fall under the right conditions. Others are a chain of cells, attached end to end. Of such are the *confervæ*, or frog spawn of our pools, and many kinds of mildew.

One division or family of these flowerless plants we call *Fungi*, and it is to this class that I will now direct your attention. They are produced from *spores*, and the different species vary much in size, from the largest mushrooms and puff-balls to the minute microscopic plants that I will describe. A puff-ball is a familiar example of the larger, the dust or smoke that puffs out when it is crushed, is a multitude of *spores*, so fine that each one is invisible to the naked eye, but the many appear like smoke in the air, yet each of these may grow and produce new puff-balls, like the parent plant.

This family of plants have certain important characters common to all its species.

They are not dependent on the light, but most of them may grow in the dark; puff-balls and mushrooms grow in the night; some species grow in caves and mines where the light never enters. They never purify the air by abstracting its carbonic acid,

and decomposing it, giving off the oxygen; on the other hand, they absorb oxygen and give off carbonic acid. Ordinary plants live on the dead matter in the soil and air, and out of it build up their living tissues.

Fungi, on the contrary, live on some substance that has lived before, it may be decaying animal or vegetable matter, it may be living things, but in all cases they cause more or less decomposition of the substance upon which they grow; if already dead they generally hasten its decay, if on a living being, they generally injure the part they live on.

You see examples of both of them very often. Ordinary *mushrooms* grow upon decaying manure and hasten its decay; other forms grow upon old logs and help to rot them. Dry-rot in timber is caused entirely by such a fungus, and I might multiply examples.

I have described the growth of a plant from the seed, let us now notice the growth of a fungus from a spore. As I have said, these spores are *very small,* a single cell. We will suppose it round, which is a common form; of course, all the process must be watched with a powerful microscope. If we place some of these spores upon a moistened slip of glass, and keep the glass moist and warm, we may study the development. First, moisture is absorbed, then this cell begins to swell on one side, the swelling increases at that point, this finally pushes out into a tube, which increases in size and length, according to the species; it may then branch, in fact, the tube is the early stage of the new plant, and if in proper condition, answers the purpose of root, takes up its nourishment if it be present, and the plant continues its growth, assuming the form characteristic of the species. (Illustrated by sketches on the black board.)

You now understand the relations between the *seed* and the *spores*, the relation is similar to that we see in the reproductive plan in different animals; one may produce an egg in which a certain development takes place after its separation from the parent, but which ultimately produces a being of the same kind; another may produce its young alive; the form was first developed within the parent, the same as the embryo is formed within the seed before it leaves the parent plant.

After this long introduction you are prepared to understand what I mean by spores germinating, and the facts I shall use. Bear in mind that fungi cause certain chemical changes in the

substance upon which they feed; the higher plants, that grow upon the *soil*, do not thus materially change the soil; they only change to any great extent the substances that come within them, but fungi cause changes in the substance they grow on or in, and come in contact with. Not only is this so of the larger mushrooms, toadstools, puff-balls, and similar familiar forms, but there are thousands of species which are microscopic in size, which produce the same effects and follow the same general laws of growth, some like the various forms of mould, growing on dead organic matter and rotting it, others on living things, causing blights, rusts, mildews, smuts, and other diseases known under a variety of names.

Now how do these kill or cause disease in plants?

I will first illustrate by a familiar example on organic matter already dead, and then pass to the living.

If we take pure sugar and dissolve it in pure water, and carefully keep it pure, even though it may be in contact with the air, it will remain sweet almost any length of time; it undergoes no change; we may evaporate the water and obtain the sugar again pure. But let us place a little *yeast* in the solution, no matter how small a portion. This yeast, if good, contains living cells. These are minute plants, generally classed with fungi. These cells grow and rapidly increase in number. As they grow, oxygen from the air is absorbed, carbonic acid is given off, and the sugar is all changed to alcohol or vinegar by their action. We may now evaporate the water but get no sugar, it has all been changed. If we boil the yeast, to kill these cells, we stop this fermentation, because we stop their growth. Or we may stop the fermentation if we kill these cells, these minute plants, in any other way; by poisons for instance. The chemical change only takes place in the solution in contact with these *living* cells.

The same thing takes place with all kinds of mold; they rot, or change the substance they flourish upon, for mold is a fungus vegetation. The rotting of timber is caused in the same way by similar fungi, and all methods for the preservation of timber from decay, depend more or less upon the prevention of such fungus growth. We char it, or cover it with paint or tar, to keep out the spores, or soak it in chemicals and poisons to kill them and prevent their growth.

Now, as I have said, certain species of fungi flourish on *living* plants, and when they do, they always cause more or less decay

of the parts they come in contact with. They sometimes rot the cells of the plant that support them, at others they change its juices, as the sugar solution was changed by yeast. This cause a multitude of *diseases* in plants, and I propose to notice in the remainder of this, and in the next lecture, some of those produced upon our cultivated crops.

One of the most familiar of these is known as *smut*, by American farmers. In wheat this is most familiar with us. During growth the plants look healthy, the heads grow large, but as the wheat ripens, we find the grains slightly larger than if sound; and instead of containing starch as they should, are filled with a black substance, like lampblack. As it blackens whatever it touches it has received the familiar name of *Smut*, in this country. The English farmers call it Bunt, the French Charbon, the Germans Brant.

This is caused by a fungus which grows within the grain, uses up its substance, and nearly fills it with its black spores. The spores may enter the wheat plant very young, be sown with the grain, and perhaps pass into the circulation in some way, to appear in the seed when that develops. We see from these diagrams the various phases of the disease. The first is a healthy ovule of wheat, just after flowering. If this is infected by a spore of smut, it changes shape somewhat, becomes darker at the base, and a little net-work like mold invests the pistils. The fungus develops then within the kernel or grain, filling it, growing with the ripening of the wheat plant, until at harvest, when the wheat is ripe, the fungus has completed its growth. If then the kernel be examined, it will be found to be filled with the black, ripened spores, and the withered plants of the mycelium of the fungus, the latter the most abundant in the centre of the kernel. If one grain in a head is affected, all generally are, but this is not universally the case.

When the wheat is threshed, the skin is broken, and the fungus is scattered as a black dust, each particle of which is a spore, to infest the next year's crop.

This disease may but slightly injure the crop, or it may be very extensive, destroying one-fourth, one-half, or even more. It flourishes in wet and in dry seasons, appears to be comparatively independent of the weather, and affects the crop upon both low and high lands, but commonly is worse on the latter. It only affects the grains attacked, those that escape are not injured. It

varies in destructiveness in different years, and in different localities the same year.

Now how does this smut continue from year to year, and how may it be obviated or prevented?

The smut spores adhere to the wheat, are sown with the seed, and thus enter the plant. We can infect plants artificially by rolling the seed grains in smut before sowing. The spores are exceedingly minute, some authors state their size as so very small that it would require eight millions to cover a square inch, or each is about one-twenty-eight hundreth of an inch in diameter. It is difficult to comprehend such minuteness. They are as much smaller than a grain of wheat as that is smaller than a small house, hence they pass readily into the vessels of the plant. Were you to string them like beads around a hair, the contrast would be like a string of beads about the neck of a child, so small are they. It seems probable that they pass into the circulation of the plant, and finally develop in the seed, but however that may be, the spores are sown with the seed wheat, and if we kill them before sowing, we may save the wheat from its ravages. Now there are several substances that will kill the spores, which do not injure the germinating power of the wheat itself.

About two hundred years ago a vessel laden with wheat sank in one of the harbors of England. The wheat was rendered unfit for food by the salt water, so was used as seed wheat, and the crop the next year that was produced from this seed escaped the ravages of the smut, while crops from other seed, in that vicinity were injured. From that time, soaking seed wheat in salt brine has been more or less used as a remedy, and is pretty effectual. The most common way is to soak the wheat in cold, strong brine, a short time, then drain out the superfluous liquor, and sow in that state, or else first roll it in lime to dry it. The brine must not be hot, or it destroys the vitality of the wheat. The refuse brine from meat is extensively used for this purpose and it answers well. It is probable also that the salt acts well on the young plant, and if rolled in lime, it is certainly thus benefited.

Brine, however, is not the only remedy, but a weak solution of blue vitriol, or *sulphate of copper* is preferred by some farmers. This is largely used in the southern States, and during the late blockade it brought enormous prices for this purpose. Even five dollars per pound was paid for it, for this use, and farmers could afford to use it even at that price.

It is not the *lime* that effects the cure, as some suppose. The following experiment mentioned in an agricultural paper last year, is conclusive. Mr. C. W. Howell, of North Carolina, sowed one hundred and twenty acres of wheat.

The seed used on forty acres was soaked over night in strong brine, (the refuse from salt pork,) and then thoroughly mixed with slacked lime by shovelling over on the barn floor. The next harvest, this had no smut.

For another forty acres the brine was diluted with an equal amount of water, and then treated as before. In this there was some smut.

For the remaining forty acres, the seed wheat was soaked in *water* and then thoroughly limed, like the rest. This was badly smutted at the next harvest.

The strong brine had killed all the spores of the smut in the seed, the weak brine a part, the lime alone had failed.

In localities where wheat is liable to smut, it is well to always soak the seed in brine, or weak solution of blue vitriol. But if these precautions are neglected, and the crop is partially destroyed by smut, then, in harvesting, let the wheat stand until fully ripe, that the smutted grains may well mature so as to be entirely broken by threshing, and thus be separated from the sound wheat.

Nearly all of our grains are more or less liable to similar diseases in the seed, caused by fungus, but with the exception of rye, the damage is seldom very considerable, at least in this country. These fungi are specifically distinct, one species for wheat, another for oats, another for corn, &c. I will not trouble you with their long Latin names, by which they are known to botanists. Another well known example of such disease is in the *ergot* or *spurred rye*. In this case, the kernel increases enormously in size, and is hard when dry, and is very poisonous.

Many cases are on record, where it has not been well separated from the grain but passed into the flour in sufficient quantities to produce the most horrid diseases and painful death. Sores break out, gangrene occurs, and the victim dies a miserable death.

Many species of fungus are poisonous, especially the molds. Cases often occur where families are poisoned by eating bread from moldy flour. And if this is aggravated by ergot in the flour, originally, then the case is much worse.

A case is recorded in England, where a whole family were so affected that they lost their limbs by gangrene; they literally rot-

ted off before the death of the victims. And not a few such cases have happened in Europe, where rye forms a larger element in the food of the people than it does here.

There is an idea prevalent among farmers that certain diseases of cattle are caused by the spurred grains of certain grasses, which are analogous in their origin to spurred rye. I know of no proof that this causes such diseases, but certain it is that many practical men hold the opinion, and when any such idea is wide-spread among practical men, we may expect to find some foundation at the bottom of it.

Another class of diseases caused by Parasitic Fungi, is known as *Rust*. This acts in a very different way. The smuts affect the seeds only, but rusts affect the stalks and leaves, and through these, the yield of the crop. As the different grain plants have their parasitic enemies which prey upon their seeds, so too they have each their rusts, preying upon other organs, and even in the same plant, we may find it infested by more than one species of parasite.

We will consider the common wheat rust as an example, and one of the most destructive of that class in this country.

When the wheat is growing, we find before its ripening, especially if the weather be close and damp, dark or rusty specks appearing upon the stalks and leaves, often in great numbers. A few may be seen most any year, but in wet years the effect is worse, in dry seasons the destruction is less. If we carefully examine the wheat and its parasite during their development, we will first find discolored patches in and just beneath the cuticle, which soon bursts, and the ruptured edges are rolled back, and a mass of fine threads are thrust out, each of which soon is crowned by a small knob, which contains about two spores. The disease then spreads rapidly, and if the weather is favorable, thousands appear upon each plant, on the leaves and stalk. The fungus has its *mycelium* or spawn growing in the tissues of wheat plants, only the fruit-bearing threads coming through the cuticle. The sap is changed by this fungus, the seeds do not develope, and at harvest the seeds are shriveled or shrunken, they have not been well filled with starch, as the healthy, plump grain should be. From the fact that grain growing on rich, mucky soil, or where there has been excessive manuring, is often more rusted than in the less luxuriant parts of the same field, many men have come to believe that rust is caused by an excess of sap bursting the sap

vessels and flowing out and drying on the outside, producing the spots. I need not say that this is entirely wrong; a good microscope will dispel any such theory.

Perhaps the strangest part of the history of these fungi is that they often assume very different forms in the different periods of their growth, and may live on different plants. You know that it is a very common opinion that our common Barberry bushes blight wheat. This opinion has been held by farmers in various countries and for centuries. Some persons have attempted to account for it by supposing that the pollen from the flowers of the barberry blighted the flowers of the wheat. But nearly all scientific men denied the fact in toto, and pronounced it a mere whim, without any foundation whatever. But Dr. Barry has recently proved by the most careful investigation, that there was a foundation of fact in the idea. The truth is, the same fungus that infests wheat and rusts it, also lives upon the barberry, and may spread from it to the wheat, but while on the barberry, it looks so unlike its development on the wheat plant, that it had heretofore been mistaken by botanists for an entirely different fungus.

For rust, there is no remedy; as it is not sown with the wheat, all treatment of the seed-wheat is useless. It is so largely dependent on the condition of the weather, that its ravages are mostly beyond our control. It is found, however, that some varieties of wheat suffer less than others; generally those with the hardest stalks suffer least. It seems that the firm cuticle of some varieties resists to some extent the ravages of the parasite. Some farmers think that liming the wheat decreases the liability to rust, but does not prevent it altogether. It probably acts by making the stalk firmer.

Should wheat be attacked, there is no remedy, but we may alleviate some of its effects by cutting the wheat early. If badly rusted, the longer it stands, the more the grain becomes shrunken, the substance that should go to the formation of starch in the grain, is destroyed by the parasite. Of the other kinds of rust, infesting other crops, I cannot here speak, from lack of time.

Of these fungi, you will perceive that for some we have a remedy, for others, as yet none, we must trust to the future, hoping that as we now know so well the *nature* of the disease, that a remedy may be discovered.

SECOND LECTURE.

In the previous lecture I noticed some of the general facts relating to parasitic fungi, and spoke more particularly of those causing smut and rust in grain. In this I will speak of the grape mildew and the potato disease, two diseases which became especially destructive about the same time, and first attracted attention the same year, 1845.

About this time a blight made its appearance in some of the vineyards of Europe, and it soon spread over the continent causing the greatest distress. In places the devastation was complete. As in similar diseases on other plants, various causes were assigned, but it was soon decided to be a parasitic fungus to which the name *Oidium Tuckeri* was given.

Before speaking of the disease in detail, let me call your attention to certain facts mentioned in the last lecture; that all the various kinds of *mold* or *mildew* are peculiar vegetable species that live and grow upon organic matter, which may be either living or dead, and that they cause chemical changes in the substance they grow upon. If it be dead, then they cause it to decay faster; if living, they often kill it, or at least, nearly always injure it, sometimes merely enfeebling the plant, at others killing the part attacked, and often causing it to rot with great rapidity. The fungus plants, moreover, are often very variable under the different conditions in which they grow, sometimes assuming one shape, and at others some other shape, so widely different that for a long time microscopists mistook them for other species, or even genera, yet they may be but different conditions of the same fungus. Furthermore, chemists were divided in opinion, whether the chemical changes that accompanied their growth were caused by them, or whether they were a sort of result induced by the chemical changes.

In regard to what constitutes distinct species among the myriad forms that these minute fungus plants assume, botanists often still disagree, but the main chemical fact that they are the cause and not the result of disease, decay and rot, is now admitted by nearly all chemists of repute. The first of these questions is of minor importance to the gardener and farmer, although of great scientific interest, but the second question is the one of vital importance, and upon this, as I have said, chemists are pretty uniformly

agreed, and farmers must accept the fact, to profit by the conclusions that scientific men have established.

We will now return to the grape disease. Vines that are healthy first begin to show the blight upon the leaves. Brown spots appear upon the surface, which, when carefully examined with the microscope, show that a growth of minute fungus has begun. The mycelium branches over the surface, and pushes into the leaf, like roots into a soil. Wherever this reaches, the part is blighted. This extends to the berry or grape, and extends over that, as it did the leaves. As its growth continues, it soon begins to fruit, that is, produce *spores*. These spores are exceedingly minute, fine as impalpable dust, only one three-thousandth of an inch in diameter, sometimes more and sometimes less, somewhat egg-shaped, a little cell, but each capable of producing a new fungus if it falls under the right conditions. So very small and light, that it may be carried by the winds to a great distance, floating in the air as the finest dust. To germinate and grow, they must be in a moist air, and have a temperature of above 60° F., hence warm, damp air, is the most favorable to their growth. Although the leaves are affected, the great damage is to the grapes themselves. The mycelium covers the berry, like a whitish mould, its branches penetrating the skin, and under their influence the pulp is changed in its chemical character, and rots.

I will not describe in further detail the successive stages of growth, nor the various forms assumed under different conditions or periods of growth; to do so would require too much time. The result is, the berry of the grape is no longer fitted for food or wine, it is destroyed, and as this goes on, the fungus produces new spores in countless millions, which rise upon every breeze just at the time when the vines are in proper condition to give them a home, the vineyards over wide areas are devastated, the vine-grower finds his labors useless, and his living destroyed. We cannot appreciate here the distress this disease caused in some places in Europe.

Various remedies were proposed, but that one found the most efficacious was the application of sulphur to the vines. There are various modes of applying it; that most popular and in the widest use, is to dust the leaves and fruit with common flowers of sulphur. This may be blown over the vines by a kind of bellows, or applied in any way. It should be applied as soon as the disease appears, and then repeated if its ravages are not checked. Sul-

phur checks other species of mildew upon other fruits, sometimes effecting a cure, in other cases not.

All the European varieties of grapes are considered by botanists to be varieties of but one original species. In America there are several native species, all specifically different from the European, giving rise to numerous varieties. For open air culture east of the Mississippi, these varieties of American origin are almost exclusively used. As I told you, in my last lecture, different species of plants support different species of fungus parasites; at least, many of the species of fungi will flourish on but one species of the higher plants, or will not produce bad results on but one species. It is probable that this is the case with the "*Oidium Tuckeri.*" It apparently belongs specifically to the European grape, and does not, to any extent, affect grapes of American origin. Other species of mildew affect our grapes, some of which yield to treatment by sulphur.

It is probable that other species of *Oidium* affect our grapes, but not the *Oidium Tuckeri.* Upon this however, microscopists are not agreed. Whether it be strictly true or not, it is certain that even in Europe the American varieties are vastly less subject to its ravages than the European, and are now being extensively introduced there, because of their less liability to this disease.

It is thought by some, that the disease, if not caused by a weak or enfeebled condition of the vine, is more liable to occur on feeble vines. Upon this there is a difference of opinion. It is conceded that some *varieties* suffer more than others, but there is no good proof that the "degeneracy of the vine" has anything to do with it. A bad season has more to do with it than bad cultivation.

Of the many other molds and blights, I have no time to speak, but will pass to the next part of the subject, relating to the *Potato Disease.* You are all familiar with the appearance and effect of this potato disease, or potato rot—that as a serious evil it is of comparatively modern date, and that in certain years the tops become blighted and the potatoes decay—that the tubers sometimes rot early in the ground, before they are dry, at others they come out of the ground comparatively sound, but rot later, in the cellar, and that when diseased they are unfit, as food, for either man or beast. Before 1840, this disease was of rare occurrence. In 1842 and '43, it appeared in Belgium, in 1844, in Canada; in 1845, not only in these countries, but on the Isle of Wight, and also in America. During the next four or five years it spread

rapidly over the civilized globe, and in some countries reduced the inhabitants to the severest distress. In Ireland it was so severe that it is estimated that over a million of inhabitants perished by the famine it caused. Between 1845 and 1865, enough was written upon the subject to fill hundreds of volumes, and the theories put forth were very numerous. Parasitic fungi was early suggested, but the theory rejected, mostly on the authority of chemists, who held the theory that the growth of the fungi was not the cause of certain chemical changes, but rather an accompanying fact. The most popular theories were, that by long cultivation, the potato plant had become enfeebled, had "run out," as farmers say, had a "constitutional weakness"—some said "too high manuring produced it," but there were numerous other theories—among them, "electricity," "the absence of salt in the soil," "bad weather," "stagnation of the juices," "an emanation from comets," "a want of ozone in the air,"—some connected it with the "cholera," others "a mysterious dispensation of Providence," like the plague, by which he punished mankind for their sins, and so on, through perhaps hundreds of theories and speculations, each having believers, and no proofs of authenticity. But long and laborious study by scientific men, has revealed the cause, which has been fully proved to be a parasitic fungus, known to microscopists as the *Peronospora infestans*. The honor of clearly proving this belongs to A. DeBary, of Berlin, a microscopist and botanist, who has devoted many years of study to this class of plants, and the diseases they produce. In 1861 he published a pamphlet giving the result of his labors. Professor S. W. Johnson translated the more important parts, and gave the results, which were published in the *Country Gentleman*, for 1863, vol. xxi, pages 57, 217, 249, 361. A blight of the tops always precedes the rot of the tuber, and the disease consequently first shows itself upon the leaves.

It starts from a *spore* of every minute size, which germinates upon the surface of the leaf. The *mycelium* enters the cuticle sometimes through the stomach or breathing holes, and sometimes directly through the cuticle, piercing the cells. After penetrating the cuticle, the mycelium extends rapidly, and branches through the substance of the leaf, living upon the chlorophyl or green matter; they are the feeding roots, as it were, of the parasite, which rapidly blight the portion of the leaf upon which it grows, pro-

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ducing brown or discolored patches. In the mean time, fruiting branches push out into the air, through the cuticle or through the stomach, bearing numerous spore-cases. These are little sacs, each producing twelve to sixteen spores. These spores are oval in shape, having at either end, a hair-like organ which is in rapid motion for some time after the spore escapes from its sac, giving it the appearance of a living animalcule and hence called by botanists zoospores. We will call them simply spores. This spore is so light that it is wafted easily by the wind. If it falls upon the leaves or stalks of the potato, and the air is moist, the motion of the hairs becomes slower, finally ceases in about half an hour and then disappears. Then the spore begins to change shape, and soon a thread-like branch protrudes from its side. This is the beginning of the *mycelium*, which then pushes through the cuticle in the manner already described, and commences its career of devastation. If the atmosphere is favorable the blight rapidly extends; the leaves die; the stalks become blighted. Fresh spores are continually produced. Some fall to the ground and are carried through the soil by water, and lodge on the potato, where they germinate, and the mycelium penetrates the tuber, causing it to rot. The mycelium will grow rapidly in the tuber, under ground, but the fruiting branches only grow above ground, on the tops or leaves, where they can get light.

All of these effects can be produced by experiment. Healthy potatoes may be made to rot by sowing the spores upon the leaves, or even upon the tuber itself. One of DeBary's experiments shows this beautifully. A perfectly healthy potato is well washed and cut into halves; each half is placed in a clean saucer and carefully covered with a bell glass to protect it from dust and outside disturbances; a little pure water is placed in each saucer, to prevent the tuber drying. Upon the cut surface of one of the pieces some of the spores of the *Peronospòra* are placed; the other piece is carefully protected from receiving any, but in all other matters the two pieces are under the same conditions of temperature, moisture, light, &c. In a few days, varying with the temperature, the half upon which the spores were sown begins to show signs of disease, the other half remaining healthy.

The surface of the tuber first begins to turn brown in spots where the spores were placed; these brown patches increase in size, until in a few days more the whole cut surface is discolored, to the depth of half a line. The change continues around beneath

the skin of the tuber, and penetrates deeper until the whole is infected. If much moisture be present, the whole mass changes to a dark, foul liquid, otherwise it dries away and shrivels up as diseased potatoes do in a dry cellar. Upon the surface, branches have appeared during this change, appearing like mold. This is the fruiting portion of the fungus, producing spores, the mycelium ramifying through the mass of the tuber, and producing decay.

With the other half of the potato things have gone on very differently. The cut surface discolors at first, as all cut potatoes do, but then the change ceases; no rot takes place, and the piece undergoes no other change than occurs in any sound potato.

The same thing takes place when the spores are sown upon the surface of an uncut potato, the spores germinate, the mycelium penetrates the skin, and then the interior of the potato becomes diseased as before. In each case a week or more is required for the disease to show itself, longer if the weather is cool.

We may produce the same effect by burying the potato in the soil, placing blighted potato tops on the ground over them, and then watering them by sprinkling. The spores will be carried down and in less than two weeks the potatoes will be diseased. The spores of this fungus may be found in the soil of an infected potato field, upon microscopic examination.

Multitudes of other experiments show the same facts, and DeBary has proved that in every case where the disease exists, there is the fungus, and where the fungus is there is disease.

Next, how is this perpetuated from year to year? The spores can not survive the winter, but the *mycelium* which penetrates the interior of the potato can survive. This has been demonstrated by various observers. In the cool cellar this mycelium may remain dormant; with proper warmth it may develop. Where the infected potatoes are wounded or the skin broken, if warm enough, fruiting branches appear upon the surface, if exposed to light, but not in darkness. The mycelium may, however, grow rapidly, and the potato as a consequence rot in darkness, but the fungus produces no spores except in the light.

Now how does the disease start in the spring? Only from diseased tubers, somewhere, which contain the mycelium. It may be in such small quantity that the tuber appears sound and healthy. After planting, as the shoots start, the mycelium follows it, passes out of the soil with them, and then commences fruiting. The extent and rapidity with which this spreads depends upon

outside conditions, moisture, temperature, &c. But these explain a multitude of facts; why sometimes a field is rapidly blighted, as if by fire; at other times only a streak is infected; why sometimes it comes early, at other times later in the season. It is easy to imitate all these conditions by experiments, and many might be related, but I have wished here to give only the main features.

I will give the following summing up of DeBary of the cause and course of the potato disease, in the language of Professor Johnson, as translated and given in the *Country Gentleman*, before cited. "A parasitic fungus, *Peronospora infestans*, exists only by feeding upon the potato plants. Its mycelium penetrates the tuber in order to hybernate in them. Kept cool and dry it vegetates but slowly or makes no growth, but in warm weather or under favorable circumstances it increases luxuriantly; then the mycelium extends itself into the stems of the potato plant in order to, sooner or later, produce its spore-bearing branches, and spores which transferred to the neighboring parts of the plants speedily penetrate the healthy tissue and produce the *leaf-blight*. The parasite spreads from one or many such sources over the field, and from one field to another, the foliage of the potato becomes discolored and the tops die down. Of the numberless spores produced on the foliage a large part fall upon the soil, and penetrate it, (washed down by the water.) Some of them reach the tubers and develop within them their mycelium, and thus insure the continuation of the life of the fungus, as the tuber insures that of the potato plant. When developed in large quantity, it produces rot and destroys the tuber. When in smaller amount it causes slight, often imperceptible patches of disease, through which it comes another year into the field, and renews its life and perhaps its ravages."

Before passing to the proposed remedies, I will devote a few words to other supposed causes of the disease. The ones most often brought forward are a sort of constitutional weakness, caused by the degeneracy in the vigor of the potato plant, from long cultivation, and by too wet soil. Let me say that the potato plant, as a species, has not thus degenerated. Tested by any rule it has not degenerated. Under the same conditions, planted from wild tubers, no more vigor of growth is demonstrated than from those which have been long under cultivation. Wild potatoes themselves rot when infested with this parasite, and many trials in nearly every quarter of the globe, have proved that potatoes

derived from seed brought from its native land but a few generations before will rot with the same facility as the long-cultivated varieties. As another proof that a constitutional weakness has not been the result of long cultivation, we may say that this plant in its wild state has a limited range of growth, but in its cultivated state it has a wider range of growth than any other cultited plant. Between the years 1845 and 1860, many attempts were made, both here and in Europe, to get more healthy varieties of potatoes by importing the original plant from the mountains of South America, and propagating new varieties from that. The plants so obtained had no especial immunity from disease over varieties produced from the long cultivated plant. Furthermore, the disease attacks the most robust and hardy kinds as well as the more feeble; and the fungus seems to prefer an otherwise healthy plant. It certainly grows with more vigor upon a healthy than upon a feeble or sickly plant.

It is a fact, however, that it attacks some varieties more readily than others. This is to be expected, as it is analogous to similar diseases in other plants. Rust and mildew do not attack all varieties of grain alike, and the same with other parasitic diseases. So, too, here, even in the same field, some varieties are much more liable to its ravages than others, *but no variety is known that is exempt from this disease.* Dealers, and interested persons, will tell you to the contrary, and they also often are loud opponents to the fungus theory of the disease. But the fact that some varieties possess a partial immunity, that they are *less liable* to disease, is an important one, and should not be lost sight of at times when the disease is prevalent. In some years, this partial resistance to the ravages of the fungus may prove for that year a positive preventative, and such years we may sometimes see certain varieties almost or entirely escape the disease, which in other and less favorable years, would show some rot.

We will now pass to the proposed remedies, or cures. It is unnecessary to notice the many remedies proposed which assumed some other cause of the disease, and then worked at this imaginary cause. In regard to the diseases of other plants, arising from similar causes, I have already told you that a *cure* can be effected only through destroying the fungus, in some way. In the grape disease, we do this with sulphur; in smut, by salt brine. In the rusts and mildews, we possess no means of economically destroying the fungi without destroying the plants they prey upon, so we

must do what we can to resist its ravages as far as possible. In the wheat plant, we drain the soil to make it drier, and the air drier over it; that the stalks may be less succulent, we harden them by the use of certain manures; or we cultivate those varieties least liable to the disease.

We possess no cure for the potato disease, because we know of no means of economically killing the fungus without destroying or injuring the tuber. The practical farmer can check its ravages, however, even if he cannot cure the disease.

1. Plant only sound potatoes, for every diseased potato is a source of fresh fungi.

2. Either plant deep, or else hill up the potatoes very high, early during the growth. It is often found that tubers lying near the surface decay, while those that lie deeper escape. The reason is obvious. The spores from the surface do not reach those deeper buried so easily as they do those near the surface. This is one of the most valuable of the proposed remedies, and agrees with experience.

3. Mowing off the tops of the potatoes when the blight appears, has in many cases saved the tubers. In other cases it has failed, because a crop of spores has already fallen on the soil, to penetrate to the tubers. The removal of the tops from the field, or leaving them in the furrows, so that the spores from them would not wash down into the hills among the tubers, would lessen the liability to rot.

4. A French gardener proposes pressing over the tops with a roller, so that the spores fall into the furrows between the hills, and are washed into the soil in that place, away from the tubers. He found that while potatoes thus treated were not entirely saved, the ravages of the rot were less.

5. Certain English farmers recommend laying off the potato tops on either side, half right and half left, along the rows, and throwing dirt upon the ridge, over the stems and roots. They state that in this way a great saving is effected.

6. Professor Bollman, of St. Petersburg, proposes to cut the tubers, and dry them by artificial heat, until they are well shrunken. This was supposed to kill or check the mycelium of the fungus, without destroying the vitality of the eyes of the tuber. It is said that an extensive potato grower in New York, the Hon. A. B. Dickinson, ten years ago adopted a similar plan with tolerable success. He cut his potatoes into thin slices with but one or two

eyes in each, and then dried them by exposure to the atmosphere. (See *Country Gentleman*, August 20th, 1857, and June 9th, 1863.) He afterward covered the pieces with a coating of tar and plaster, as a further protection.

7. Mr. Holland, (of Sussex, England,) strips off the leaves as soon as they show signs of the blight, and cuts away the diseased stems, and also hills up the rows higher, beginning indeed by planting on a ridge.

Other ways may suggest themselves to the intelligent farmer. If the fungus theory is generally accepted and understood, I question if the rot will ever again occur on such a general scale as it has in times past, even though we may not be able to cure it entirely.

It must be borne in mind that the weather exercises a most important influence in all these diseases. Molds, mildews, blights and rusts spread faster and are more destructive in damp, warm weather, and also on wet soils. Thorough drainage lessens the liability.

I have said that this disease began to be noticed extensively about 1845, but that it appeared in 1842. Now it must be borne in mind that the disease did not *originate* then; it was merely brought into notice by its greater ravages. The disease is perhaps as ancient as the potato itself. As I have stated, it is found even upon *wild* potatoes, in its native country, and in unfavorable years shows itself in the cultivated plant in its native country. Joseph Acosta, a Jesuit, observed in Peru, in 1571, about three hundred years ago, that the potato tubers often spoiled in the earth during or after cold, bad weather, from "blight or mildew."

Boussingault sent to the Paris Academy, in 1845, a letter from Bogota, in which it was stated that on the table lands in that vicinity, the potato spoiled in moist situations every year, *and in wet seasons spoiled everywhere.* This is near the original home of the potato.

In a treatise on the potato written by Ludwig, in 1770, but fifty years after its general field cultivation in Germany, and before it was widely cultivated in France, occurs a description of a malady or "visible blight," like the present disease. In Alsace in eastern France, a malady precisely similar, and probably the same, occurred in 1816, and other cases might be multiplied. It seems probable that it originated with the original wild potatoes, and afterwards spread to the cultivated plant.

Precisely why it so suddenly assumes such formidable properties, is not so easily explained; several causes probably contributed to it. The potato had become widely spread, and probably the atmospheric conditions were peculiarly favorable. The simultaneous spread of the grape disease, at the same time, may indicate that the atmosphere of those years was unusually favorable. I consider the cause of the disease to be well proved, but it does not follow that one can explain all the phenomena connected with it. As I stated at my first lecture, there has been much light thrown on this matter, and we hope more still will emanate from researches now in progress, and let us strive to bring all the aids which modern science can give, to the great question of improving our agriculture. In this obscure branch of science, from the very nature of the case, practical farmers can not become extensive investigators into the causes of the disease, but they can use the knowledge obtained by laborious scientific research; and in turn aid science by applying its principles, and bringing the suggestions that arise from their experience, back to the scientific investigator.

AGRICULTURAL DRAINAGE.

THE THEORY OF UNDER-DRAINAGE AS ACCEPTED BY A PRACTICAL MAN:

A lecture delivered at the Royal Agricultural College, Cirencester, by J. B. DENTON.

In my introductory remarks, I stated that the object of my lectures was to afford such illustrations to the teachings of your professors as my practical experience enabled me to give, and it may, probably, appear inconsistent with this statement, for one who claims to be simply a practical man, to dwell on the "Theory" of under-drainage, and particularly will it appear so to those who regard the theory of an art as a doctrine ending in speculation, instead of being, as it really is, the connection of truths based on philosophical principles, and confirmed by practice.

This meagre definition of the meaning of "Theory" may fall short of true scholastic teaching, but it serves to express the acceptation it is necessary you should give to it; for it is quite certain that a practical man, who can only do what he has been taught to do, and whose skill and judgment is confined to his own small range of occupation, is not the man to appreciate the objects nor develop the attainable results of under-draining. No man of any position as an engineer trusts wholly to his own experience, but he gathers knowledge from observation every hour of his life; and as his practice is enlarged, he tests it by recognised theories, and so gains increasing confidence. Holding these sentiment, it will not surprise you that I should admit that I am still learning the Art of Agricultural Drainage, though I have been busily engaged in it for twenty years; that I should declare that the best work of under-draining is that in which exists but a minimum of error; and that the time has arrived when we should look the future fully in the face, and see if past experience does not show us practices to avoid as well as practices to maintain.

A painstaking unprejudiced man finds that, instead of looking upon the theory of his art as a matter for ridicule, he must make it the study of his thoughts, and that ignorance is often dignified with the title of "Practice," when a knowledge of principles is decried as "Theory." This is especially so with drainage, an art in which the study of Nature's varied laws forms the most useful lesson.

The theory of under-draining must be considered under three heads; viz.,—1st, the mechanical or physical changes produced by under-draining in the soil; 2d, its chemical effects; and 3d, the improved temperature resulting from it. But as the proper mode of draining is essentially different in different soils, and in dealing with different descriptions of wetness, it is necessary, in order to follow the observations I am about to make, to classify the lands suffering from wetness, and the causes of that wetness, under their respective heads.

All wet soils may be divided into four classes:—1st, free soils; 2d, clay soils; 3d, peaty and vegetable soils; and 4th, mixed soils, consisting of different proportions of these three.

1. The surcharged *free soils* (non-retentive), in their undrained state, gradually get rid of the water as it rises to the surface from the subterranean level, by evaporation from the surface, by the demands of vegetation, and by percolation through the soil from a higher to a lower level, where it finds a discharge at the surface.

2. The *clay soils* (retentive,) in their undrained state, retain nearly all the water they absorb, until released by evaporation and appropriated by vegetation. A very small proportion oozes from the clay strata into the rivers, or into the free soils and porous rocks with which they are in contact.

3. *Peaty soils*, being capable of suction or capillary action to a great extent, likewise give off, in evaporation, a large proportion of the water they absorb while in their undrained state; but the effect of draining is much more active in them than in clay soils.

4. All lands which are not distinctly free soils, clays or peaty soils, will be found to possess the above characters in varying proportions, and in their undrained state retain water and give off vapor in proportion to the clay they contain, and their capability of natural drainage.

The wetness of soils may be stated to arise from one of three causes.

1. The "Rain," which falls directly on the surface, and is properly called "surface water."

2. "Springs," which rise to the surface from underground courses, and may be called "effluent water," and which, after reaching the surface, spread over it, and become injurious to a considerable space of land around.

3. That moisture which is produced by water from distant and

adjacent higher lands pressing up through free soils of a lower level, and which may be called "diffluent water."

I.—*As to the Mechanical Effects of Under-Drainage.*

Each description of soil has its appropriate mode of drainage, and each character of wetness commands a special mode of removal; but the atmosphere takes such a prominent part in bringing about the desired mechanical changes in clays, which are retentive soils, that it is positively necessary to regard the art of draining them as distinctly different from that of draining free soils, which are not retentive.

The surcharged free and peaty soils being naturally "*percolative*," are only wet from position, and they require just sufficient outlet for the water pent up within them to turn stagnation into motion, and to create, in point of fact, a sub-irrigation for the benefit of the roots of plants. You have observed, no doubt, the effects of *moving* water on the surface of our irrigated meadows, and have seen that it is not wetness that is wanted, for these meadows are generally too wet before the water is turned on, but that it is *motion*; and so it is with the under-drainage of our free soils. In them the true art of draining is in doing as little as will attain this object. When once drained they possess the same capabilities as those which are naturally dry, and they are equally susceptible of absorption, the only difference being the depth of the subterranean water level, which, in the case of the high and dry lands, sinks beyond the reach of evaporation; while in the case of drained lands, though sunk by the operation of draining lower than before, still remains within reach of the atmosphere.

The clays, on the contrary, though rendered capable of "*permeation*" by under-drainage, still hold their peculiar powers of retention and expansion, which limit their capabilities of absorption, and cause them to resist, when the surface is not properly and deeply cultivated, the admission of falling rain. The clays are the "conservatives" of the soil. They hold the moisture they seize, and give it out gradually, except on occasions of heavy downfalls, after their own capacity for retention has been satisfied, when they readily discharge the excess. These soils cannot be aërated too much, as it is only by aëration that their retentive nature can be held in subjection. In clay lands, the more perfectly the aërating action of the drains tells upon the mass of soil between them, the quicker and more uniform the passage of surplus

water through it, and the only limit to the number of drains to produce this result *is the cost*. The true art of draining is not confined to ejecting surplus water, but extends to the complete aëration of the soil drained. You must bear in mind that all the drainage in the world will not alter the constituents of clays; it merely alters their condition. There are persons who think that if clays are drained they become as ductile as free soils, but it is a mistake; they still retain their peculiar properties, and when fitly treated are as grateful as any; when abused they become the *noli me tangere* of soils.

In free soils, which are not subject to expansion, and through which water descends by percolation, as evenly as through a fine sieve, you will readily understand how simple the effect of drainage is.

But it is not quite so easy to those who have not minutely watched the effects of drainage on clay soils to understand that water and air will penetrate their bulk. Their retentive powers and their expanding and contracting qualities, always at work, as water is absorbed and withdrawn, are peculiarities which render them altogether dissimilar to free soils. The water that is instantly absorbed and percolates a free soil of even texture quite regularly, finds a check in clays which are not broken up by deep cultivation; and were it not the fact that there are few clays that are not threaded with natural sand and gravel veins, more or less minute, and that there are none which do not crack as they contract, the believers in impermeability would gain ground. No water can be taken away from clay soils by drainage or evaporation without contraction, and there can be no contraction laterally without cracks. The space the water has occupied in the soil is then claimed by the atmosphere, and drainage by underground conduits converts those cracks into constant channels, fixed and secured by the minute particles of soil and manurial matter which descend with the rain, and prevent the re-adhesion of their sides. The greedy capacity which enables clay soils to absorb from 40 to 70 per cent. of their weight of water, is thus counter-balanced by the natural laws which oblige them to give it up to drainage and the atmosphere. After drainage, disintegration becomes year by year more perfect, the ramification of the cracks and fissures more and more minute, and thus the soil becomes more susceptible to the influences of gravitation downwards to the drains, and capillary attraction upwards to the surface. The best evidence of this

gradual amelioration of clay subsoils is to be gained by the microscope, by which it will be seen that both their texture and color undergo decided change in the course of a few years.

It is difficult to demonstrate a theory relating to the soil on which we tread, and which our eyes do not penetrate; so that the mechanical effects of draining must remain subject to some doubts. All the prettily drawn cracks *radiating from the under-drains*, which you see in books, are pure fancy. Doubtless, there are in all clays, fissures, cracks, root veins, and sand galls; they do not, however, influence under-drainage as beneficially as some people suppose. On the contrary, they interfere with that general permeation which is the object aimed at.

The most correct description of the altered condition of clay soils by under-draining is given in Morton's "Arthur Young's Calendar." p. xi.:—

"Any one who has read on the subject of land drainage, has had his attention directed to an extension of the network of cracks and fissures throughout the subsoil consequent upon the drainage of the land, by means of which it is supposed that the action of deep conduits in the drainage of stiff clays is effected. I believe that this idea does not rest upon observation, but has been invented to explain the undoubted action of deep drains in clays to those who might otherwise continue sceptics; and the speculation is, probably, a mistake. If water found its way through cracks and fissures to the drains, it would have comparatively little fertilizing influence. What we want is, that the water passing through our soil shall wrap round every particle, and not wash merely the cracks and fissures in its passage. These fissures have not been seen, they have been merely fancied; but water has been *seen* oozing from a surface at every pore. And that clays are porous is proved by the fact that they are wet; whenever we shall find, on digging downwards, that the subsoil which we reach contains no water, then we may admit that it is needless trying to drain the water from it, but so long as it is seen that water has gone through it without the aid of those cracks which drains are supposed to make, so long must it be admitted that, without the aid of those cracks, it will pass through it out of it."

It is hardly necessary to point out to you the ignorance of supposing that water enters a connected system of under-drains from the tops of the pipes. In free soils, and in clays when the under-

drains by "reciprocal effect" have produced pulverization, the rain entering the soil passes perpendicularly down, and having reached the standing level of the water in the soil, raises that level and flows off by the pipes. It thus necessarily enters at the bottom of the pipe and not at the top.

I shall place before you hereafter the best evidence of the draining capabilities of clays by the results of experiments made on actual drainage; but that you may at once appreciate "the *reciprocating* effect," as I have ventured to call it, of frequent under-drains in the stiffest and purest clay, I will explain that to produce uniform permeation the drains must be sufficiently near each other to produce a reciprocal effect, *i e.*, the effect of every drain shall extend so far towards and into its neighbour's region on each side that the rain and air shall descend to the level of the drains. That the drainage of clays is only to be effected by this compound action is proved by the facts—1*st*, that open cuts, which will completely empty a free soil of water, have little or no effect in draining clays, though the surplus water will be quickly set in motion if the open cuts are changed into covered ones; 2*d*, that a porous stratum, which is in itself a natural drain, lying under a stratum of saturated clay, has no perceptible effect in drying it if the thickness of the clay is beyond a certain limit, although the clay will directly yield to the action of under-drains if placed sufficiently near each other to reciprocate their influence, and aërate the soil between them; and 3*d*, that a well dug in a saturated clay does not fill with water up to the level of saturation, as would be the case with a free soil, although uniform frequent drains will extract water from the clay, even when the well itself is dry. I introduce these illustrations here because I wish to satisfy you that there exists a difference between the characteristics of free soils and of clays, so marked that you cannot truly comprehend the theory of under-drainage unless you recognize the peculiar physical changes to be brought about in each. I recognize a distinction in the filtrating process in free soils and in clays, and have adopted different words to express the action in each. By common acceptation there is little difference in the meaning of the two words "percolation" and "permeation;" but I do recognize a difference, and apply the former word to express the passage of water through free soils, and the latter to that through clays. Etymologically, too, I think I am right. In free soils there is no resistance beyond friction to the force of gravitation; and a due

consideration of this fact enables the drainer to calculate the minimum number of drains which, by taking advantage of the shape of the ground, will release the surplus water, and maintain a proper amount of moisture in the soil. You may readily over-drain free soils. In clays the case is very different. So great is their succulent capacity, and their power of retention, that the general action of the under-drains does not take place until they have absorbed, and hold within their bulk, the maximum quantity they are capable of retaining. You cannot overdrain clay soils.

If the stagnant water level in wet lands be lowered to an adequate depth, in the case of free soils by as few drains as will set the pent-up water in motion, and in the case of clays by as many drains as will perfectly aërate the depth of soil between surface and drains, then the mechanical conditions secured are adequate—1st, to render the soil capable of absorbing the rain that falls upon its surface, in all cases where the shape of the land and its cultivation will allow of the rain resting where it falls; 2d, to ameliorate and disintegrate the soil by the infiltration of rain water and the passage of air which follows the water from the surface to the depth of the drains; 3d, to secure the passage of the rain *vertically* and as evenly as possible to the full depth of the drains, and the carriage of so much of the finer particles of soil and manurial matter, as the rain will displace and take with it in its passage downwards through the soil; 4th, to prevent the rising up to the surface of the diffluent water of pressure, and to confine within the narrowest limits the effluent water of springs.

II.—*As to the Chemical Effects of Under-drainage.*

With these mechanical conditions secured, the resulting chemical changes produce an increased fertility and a better adaptation of the land to the operations of tillage. Every one of you must have observed how our cultivated plants, our crops and trees, dislike stagnant water; and how their roots travel along its surface underground directly they reach it. The existence of stagnant water implies the absence of air, which is as essential to the development of vegetable growth in the soil as it is to our existence above the surface, and therefore we can readily understand how essential it is to render the depth of soil which our plants require for their perfect development, percolative or permeable, free or active. This is not only required because roots will not penetrate a bed of stagnant water, and will prosper in a deeper feeding

ground, but because there are in soils organic and inorganic ingredients which require alterations, only to be effected by the absorption of gases from the atmosphere. By drainage you not only afford to plants the deeper bed to sustain them, at the rate of 100 tons per acre for every inch of depth gained, but you correct the influence of injurious constituents of the soil, and, what is more, you carry into the deepened bed those fertilizing ingredients which are constantly associated with fresh air and moving water.

We are too much inclined to look upon the earth as a compact body of inert matter. There cannot be a greater mistake. I have known several instances in which the extreme sensibility of the subsoil has been evidenced, nor have I as yet arrived at the limit to which the atmosphere will penetrate a free soil. I do not say the same of clays. Their retentive and expanding qualities do impose a limit. On several occasions my attention has been called to the fact that drains previously dry have commenced to discharge without any rain falling on the surface of the drained land, and these observations have been confirmed by others who have recorded the same thing. In the Hinxworth experiments, published in the Journal of the Royal Agricultural Society, vol. xx., you will see this striking phenomenon referred to, and Mr. Charles Fowler of Henlow, Bedfordshire, and Mr. George Beaumont of Bridgeford Hill, Nottinghamshire, have communicated to me their confirmation. The latter gentleman wrote to me some few years back as follows:—

"I can verify the case of the drains running without rain during a falling barometer beyond all doubt.

"The case I named to you last year of the barometer falling four days consecutively, and with rapidity, was a peculiarly favorable time for noticing it, as it occurred in a dry time, and the drains could be seen distinctly. My man, on being questioned and cautioned by me not to exaggerate, has declared the actual stream of water issuing from one particular drain to be as thick as a ⅜ inch wire. All the drains ran—they did more than drop—and ditches which were previously dry became quite wet, with a perceptible stream of water; this gradually ceased with the change in the density of the atmosphere, as shown by the barometer.

"During last harvest, 1855, the men were cutting wheat, and on getting near to a drain outlet, the ditch from the outlet downwards was observed to be wet, and the drain was dripping. No

rain fell in sufficient quantity to enter the ground. The men drank of the water while they were cutting the wheat. A few days after it was dry again. I have seen and noticed this phenomenon myself."

Dr. Lardner in his "Lectures on Science" says:—

"When storms are breaking, and sometimes long before their commencement, and when their approach has not yet been manifested by any appearance in the firmament, phenomena are observed apparently sympathetic proceeding from the deep recesses of the earth."

Professor Brocklesby, of Hartford, U. S., has recorded his observations on two springs in America, which corroborate the observations we have made in England on the discharge of underdrains, and he explains the cause to be "the diminished atmospheric pressure which exists before rain."

If we can thus trace facts which strike us as remarkable phenomena, how much more readily should we give credit to the effect of aëration and the circulation of water in ameliorating the subsoil by disintegration, and thus promoting vegetation? The benefit derived from disintegration, *i. e.*, the comminution or minute division of soils, will be readily understood by those who have studied the views of Jethro Tull, a writer who went so far as to maintain that land deeply and frequently stirred gathered sufficient fertility from the atmosphere to keep up its inherent powers; and by those who have visited Mr. Smith, of Lois Weeden, who, in "his treatment" of land, has adopted the same theory. I do not advocate these extreme views as capable of general adoption in farming, but I do not hesitate to say that the principle of aëration is a sound one, and that we should recognize in the atmosphere a source of fertility available for surface soils by deep cultivating, and for subsoils by deep draining. Dr. Madden, in an admirable paper published in the Transactions of the Highland Society in the year 1846, thus explains the effects of disintegration:—

"When water is added to perfectly dry soil, it, of course, in the first instance, fills the interstitial canals, and from these enters the pores of each particle; and if the supply of water be not too great, the canals speedily become empty, so that the whole of the fluid is taken up by the pores: this, we have already seen, is the

healthy condition of the soil. If, however, the supply of water be too great, as is the case when a spring gains admission into the soil, or when the sinking of the fluid through the canals to a sufficient depth below the surface is prevented, it is clear that these also must get filled with water so soon as the pores have become saturated. This, then, is the condition of *undrained soil.*

"Not only are the pores filled, but the interstitial canals are likewise full; and the consequence is, that the whole process of the germination and growth of vegetables is materially interfered with. We shall here, therefore, briefly state the injurious effects of an excess of water, for the purpose of impressing more strongly on your minds the necessity of thorough draining as the first and most essential step towards the improvement of your soil.

"The *first* great effect of an excess of water is, that it produces a corresponding diminution of the amount of air beneath the surface, which air is of the greatest possible consequence in the nutrition of plants; in fact, if entirely excluded, germination could not take place, and the seed sown would, of course, either decay or lie dormant.

"*Secondly*, an excess of water is most hurtful, by reducing considerably the *temperature* of the soil: this I find, by careful experiment, to be to the extent of six and a half degrees Fahrenheit in summer, which amount is equivalent to an elevation above the level of the sea of 1950 feet.

"These are the two chief injuries of an excess of water in soil which affect the soil itself. There are very many others affecting the climate, etc.; but these are not so connected with the subject in hand as to call for an explanation here.

"Of course, all these injurious effects are at once overcome by thorough draining, the result of which is, to establish a direct communication between the interstitial canals and the drains, by which means it follows, that no water can remain any length of time in these canals without, by its gravitation, finding its way into the drains.

"Too much cannot be said in favor of pulverizing the soil; even thorough drainage itself will not supersede the necessity of performing this most necessary operation. The whole valuable effects of ploughing, harrowing, grubbing, etc., may be reduced to this; and almost the whole superiority of *garden* over *field* produce is referable to the greater perfection to which this pulverizing of the soil can be carried.

"The whole success of the drill husbandry is owing in a great measure to its enabling you to stir up the soil well during the progress of your crop; which stirring up is of no value beyond its effects in more minutely pulverizing the soil, increasing as far as possible, the size and number of the interstitial canals.

"Lest any one should suppose that the contents of these interstitial canals must be so minute that their whole amount can be of but little consequence, I may here notice the fact, that, in moderately well pulverized soil, they amount to no less than one-fourth of the whole bulk of the soil itself. For example, 100 cubic inches of *moist* soil (that is, of soil in which the pores are filled with water while the canals are filled with air) contain no less than 25 cubic inches of air. According to this calculation, in a field pulverized to the depth of eight inches,—a depth perfectly attainable on most soils by careful tillage—every imperial acre will retain beneath its surface no less than 12,545,280 cubic inches of air. And, to take one more element into the calculation, supposing the soil were not properly drained, the sufficient pulverizing of an additional inch in depth would increase the escape of water from the surface by upwards of one hundred gallons a day."

You must bear in mind that not only does the descending rain (which is 817 heavier than air) take the place of any air existing in the interstitial spaces of the subsoil, but it drives before it any water which is upheld by attraction within them, and thus supplies to the subsoil the manurial matter which is brought down in the water, as well as that which accompanies the air, following that water, as it drains away.

I assume that you are alive to the common law of hydrostatics, which rules that water in draining can only be put in motion by the admission of air to its surface; and that no water can run from the soil without its place being occupied by air or a fresh supply of water. Realize these facts in your mind, and remember that air contains, besides oxygen essential to vegetable vitality and vaporized moisture which serves to maintain it in dry seasons, a variety of fertilizing substances exhaled from the surface of the sea and from decomposing animals and vegetables, and such as arise from the breath of living creatures, and from combustion and other causes, and you will comprehend the vast benefit to be derived by vegetation from the circulation of the air through soils. Think of the quantity of ammonia evolved from the manure of our

farm-yards and dung-heaps, and from all the refuse and sewage of our towns. This is, in part, returned to the earth by the rain and dew which falls upon it. Both rain and dew will absorb 700 times their own bulk of ammonia, and thus enriched they descend through the soil to the roots of plants, making drained land the recipient—the grateful recipient—of those impurities with which the atmosphere was charged, but of which it has been cleansed by absorption. No better filterer and deodorizer has yet been found than the ordinary soils forming the crust of the earth, and these effects are realized on all soils through which water will descend.*

III.—*Under-drainage of adequate depth diminishes evaporation and improves the temperature of the soil.*

A very important element in the consideration of the effects of under-draining is the upward action of water from the level of the drains by attraction, which is often spoken of as a power of sufficient force to resist gravitation. The power of soils to absorb and retain water does not, however, in any way interfere with the required action of drainage; neither is their retentive power a positive index of the height to which it will rise within them. I mean by this that the quantity of water a soil will soak up is not necessarily the measure of the height to which water will rise by attraction from the level of the water-bed. Clayey soils, of which the proportions of sand and lime vary, all differ in their capability of absorption, and more widely still in the power of attraction. The principal clays of England have been found, by careful experiments, to exhibit their absorbent and retentive qualities in the following comparative degrees :—

	Will soak up water.	And will expand.
Oxford Clay,	342	340
Wealden Clay,	357	420
Lias Clay,	362	390
Warp Clay,	400	215
Boulder (drift) Clay,	506	600
New Red sand-stone Clay,	520	430
London Clay,	554	534

I give these figures to show you that while one clay will absorb 2-5 of a given quantity of water, and will expand 1-5 of a given space, another clay absorbing rather more than half the same quantity of water, will expand to half the given space; so that with a small additional power of absorption, the extent of expansion is double in the latter case to what it is in the former. This

will show you how difficult,—nay, how impossible,—it is to set limits to so uncertain a power as attraction.

It has been stated by some superior men, that drainage even increases evaporation; this would render the land colder than before, and would make the perennial supply of water to our rivers less,—results which are certainly not the object of under-drainage. My own conviction is, as I have before said, that drainage does increase the power of attraction in the soil, but that the facilities afforded to attraction being equally open to gravitation, and the latter being the more powerful of the two, infiltrated rain gains the mastery and drives the water of attraction before it, and thus expels from the soil, by the drains, that which would otherwise go off by evaporation.

Leaving science in its future advances to settle these important details, we may be content to believe that if under-drainage maintains the level of saturation at an adequate depth below the surface of the soil, the line of moisture supported by attraction must be further from the *direct* and prejudicial influence of the sun and wind in drained soils than in those undrained, and that land in a saturated state is in a more effective condition to yield to evaporation than land in the modified condition of healthy moisture.* I have before referred to the experiments of Dalton, Charnock, and Dickinson, made with a view of ascertaining the difference of evaporation from drained and undrained soils, and I will only now remind you that they all take the measure of that difference to be

* An interesting communication bearing on this subject is found in the *Gardeners' Chronicle* of September 27, 1864, of which the following is an extract.—Ed.

"He may depend upon it that deep tillage has a double power of vegetable sustenance among its advantages. It facilitates the deeper rooting of our plants, and, by its multiplication of that inner superficies of the soil and subsoil on which their capacity as a warehouse of food for plants depends, it doubles and quadruples their ability to store up and retain the moisture which will penetrate them against the time when it will be wanted.

"And this is now no mere theory. Thanks to Professor Church, of the Royal Agricultural College, we are able, in a particular example, to state accurately the quantity of moisture existing in the subsoil after a summer's drought, under differing treatment and different conditions of the soil above it.

"The layer examined was the 13th inch downwards from the surface of the ground. One foot of soil was removed, and the next inch taken for examination, and the quantity of water which that inch of soil contained, was ascertained in the usual way. It will be seen from Professor Church's account that nearly 29 per cent. in weight of the layer in question was water where the soil had been deeply cultivated; while a similar layer taken in another case on lower ground from beneath 12 inches of soil which had not

the quantity of water discharged by drainage. They do so on the ground that whatever water penetrates a depth of four feet is beyond the recalling influence of attraction, and therefore beyond the powers of evaporation, and they assume that the land now wet when drained will be brought to the same condition as land naturally dry. But it cannot be so. In the case of lands naturally dry the infiltration is by simple percolation through a free soil, and the depth of the subterranean water level is altogether beyond the reach of the atmosphere. In the case of lands from which excessive water is removed by drainage, the water level itself remains within the influence of the atmosphere, though to a modified extent. The cases, therefore, are not parallel.

Nevertheless, when we see the under-drains of surcharged free soils discharging sometimes as much as ten times the quantity of water as falls on their surface in the shape of rain, and the drains of clay soils discharging as much as from 1-5 to 1-6 of the rainfall, we have the tangible satisfaction of knowing that these copious discharges must first replenish our rivers before they can replenish the rainfall; and when we frequently find that by the action of under-draining we establish a constant flow of water from lands which have never given out water in the shape of springs before, we have the additional consolation that we have entrapped an enemy, and made him a friend, for we have not only prevented his coming to the surface and chilling the land by evaporation, but we have created a permanent addition to the water supply of the

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been moved at all, contained only 19 per cent. of water. Even this seems a very large quantity, but it must be remembered that the last portions of mechanically combined water are given off with extreme reluctance, and that the difference between 28.8 and 19.2 per cent., less than 10 per cent. as stated in figures, may be all the difference between a very deficient and scanty provision, and practically none at all for the growing plant. These experiments of Professor Church, which furnish an instructive lesson on the value of tillage operations at any time, appear to us especially interesting at the present, when we are suffering from a summer's drought so unusual. The following is the report of them with which we have been favored :—

"'The following experiments were made in order to determine the comparative amount of mechanically combined water in uncultivated and cultivated soils, after the long continued and severe drought of this summer.†

"'The samples were taken August 20. In each case a foot in depth of soil was removed, and the next inch taken as a sample for experiment. The foot was measured from the level of the neighboring turf.

"'No. 1. A bed in the Botanic Garden.—It had been deeply cultivated (16 inches)

† During the months of April, May, June, July and August, the amount of rain had only been 6 37 inches, *i. e.*, 6.45 inches less than the average during the same months in the last nineteen years —Ed.

country. You will do well to study with care the admirable essay of Mr. Josiah Parkes, "On the Influence of Water on the Temperature of Soils," in the *Journal of the Royal Agricultural Society,* and the more recent essay entitled "Land Drainage," written by the late Mr. Gisburne, which appeared originally in the *Quarterly Review,* and was republished by Murray in a cheap pamphlet form. I object, and I cannot do so too earnestly, to the advocacy by both these able men of one uniform character of drainage, *i. e., parallel straight drains four feet deep,* for all soils and all surfaces alike; but I know of no better means of understanding the effect of evaporation in rendering the ground cold than by studying their essays. The best *rèsumè* of the arguments of both is to be found in the short article by Dr. Lyon Playfair, entitled "Drainage," in the *Cyclopœdia of Agriculture;* but the work that will be most popular with a young student is, perhaps, Judge French's *Farm Drainage* published in New York. It is graphic, but, like both Parkes and Gisburne, Judge French assumes that clays and gravels saturated with water, with regular and irregular surfaces, are alike amenable to parallel drains four feet deep at various intervals. When I commend these valuable essays, therefore, I qualify my commendations by protesting against this one great practical fallacy.

Every one knows that the only way for surplus water, which does not infiltrate to a subterranean level, to escape from land, is by exhalation into vapor; and, though perhaps not equally well

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in autumn. At the time of taking the sample nothing was on the ground. Percentage of moisture = 28.6.

"'No. 2. Uncultivated ground in the Botanic Garden.—It has never been disturbed within memory; it was covered with rough turf, but the sample was taken from a spot nearly bare, the turf having shortly before been removed to the depth of an inch or two. This ground was about one foot lower in level than that from which No. 1 was taken. Percentage of moisture = 19.2.

"'No. 3. Ground in kitchen garden, trenched in autumn (16 inches.) Carrots had been grown on part, not on the portion from which the sample was taken. Percentage of moisture = 26.2.

"'No. 4. Ground in kitchen garden.—It had been dug once in autumn (8 inches) to about half the depth of No. 3; a crop of chalots since; at time of taking sample nothing on the ground. Percentage of moisture = 20.5.

"'I should add, that with the exception of a heavy shower of rain in the middle of July, we have had scarcely any wet since the spring; it will be seen that the samples were taken before the commencement of the late rains. The soil experimented on is a light calcareous clay loam, resting on the forest marble.'"—A. H. CHURCH, *Royal Agricultural College, Cirencester,* August 30, 1864.

known, it is equally true that heat disappears or becomes latent by the conversion of water into vapor. It is this effect on the moistened skin that produces cold in human beings when they expose themselves to the action of the air, and precisely the same evil attends the exposure of the moist soil to the sun and wind. An application of this homely bit of philosophy has led to the manufacture of ice in the hottest climates; and I once convinced a doubtful farmer of the chilling effect of evaporation on his land by hanging a bottle of his port wine clothed in wet flannel before a kitchen fire.

To reduce the effect of evaporation to tangible figures, I may state that every gallon of water carried off from the soil by evaporation robs the soil of as much heat—heat, remember, which is beneficial to vegetation—as would raise 5½ gallons of water from freezing to boiling point. You cannot be surprised, therefore, that saturated lands should be called "cold" as well as wet.

Heat will not pass downwards in water, and, if the soil is saturated, the warmth of the atmosphere cannot penetrate it. Heat is propagated in water by circulation, that is, by the upward movement of the heated particles, and the downward movement of the colder ones to take their place. Heat is conveyed to a soil by the circulation of the air and water through its recesses, and this fact considered in relation to what I have before said, will help to explain how it is that water occupying the interstices of the subsoil by attraction, is forced downwards by descending rain which is warmer than itself.

Mr. Gisburne says in his Essay :—

"To ascertain the mean heat of the air at the surface of the earth over any extended space, and for a period of eight or nine months, is no simple operation. More elements enter into such a calculation than we have space or ability to enumerate; but we know certainly that, for seven months in the year, air, at the surface of the ground, is seldom lower than 48°, never much lower, and only for short periods: whereas, at 4 feet from the surface, in the shade, from 70° to 80° is not an unusual temperature, and in a southern exposure in hot sunshine double that temperature is not unfrequently obtained on the surface. Now let us consider the effect of drains placed from two to three feet below the water-table, and acting during the seven months of which we have spoken. They draw out water of the temperature of 48°. Every particle

of water which they withdraw at this temperature is replaced by an equal bulk of air at a higher, and frequently at a much higher temperature. The warmth of the air is carried down into the earth."

What part dew and atmospheric moisture take in under-ground circulation we cannot so precisely state, but it may be safely believed, that when air highly charged with moisture passes through the earth, it must, by contact with the subsoil, part with large quantities of moisture for the benefit of vegetation. It is this which gives an appearance of freshness in dry weather to the grass above mole-tracks, and makes the courses of drains so distinguishable on the surface.

A short description of dew is given in Judge French's work on under-drainage, which I will quote in conclusion, as it will probably enable you the better to appreciate the part it takes in refreshing the drained soil in summer:—

"Dew is one of the most ordinary forms in which moisture is deposited in and upon the soil, in its natural conditions. The absorbent power of artificially dried soils, as has been seen, seems to depend much upon their chemical constitution; and that topic has been considered, without special reference to the comparative temperature of the soil and atmosphere. The soil, as we have seen, absorbs moisture from the air, when both are of the same temperature, the amount absorbed depending also upon the physical condition of the soil, and upon the comparative moisture of the soil and atmosphere.

"The deposition of dew results from a different law. All bodies throw off, at all times, heat by radiation, as it is termed. In the day-time, the sun's rays warm the earth and the air is heated by it, and that nearest the surface is heated most. Evaporation is constantly going on from the earth and water, and loads the air with vapor, and the warmer the air the more vapor it will hold.

"When the sun goes down, the earth still continues to throw off heat by radiation, and soon becomes cooler than the air unless the same amount of heat be returned by radiation from other surfaces. Becoming cooler than the air, the soil or plants cool the air which comes in contact with them; and, thus cooled to a certain point, the air cannot hold all the vapor which it absorbed while warmer, and part of it is deposited upon the soil, plant, or other cool surface. This is dew, and the temperature at which the

air is saturated with vapor is called the dew-point. If saturated at a given temperature with vapor, the air, when cooled below this point, must part with a portion of the vapor in some way; in the form of rain or mist, if in the air; in the form of dew, if on the surface of the earth.

"If, however, other surfaces at night radiate as much heat back to the earth as it throws off the surface of the earth is not thus cooled, and there is no dew. Clouds radiate heat to the earth, and, therefore, there is less dew in cloudy than in clear nights. If the temperature of the earth sinks below the freezing-point, the aqueous vapor is frozen, and is then called *frost*.

"To radiate back a portion of the heat thus thrown off by the soil and plants, gardeners cover their tender plants and vines with mats or boards, or even with thin cloth, and thus protect them from frost. If the covering touch the plants, they are often frozen, the heat being conducted off by contact to the covering, and thence radiated. Dew, then, is an effect, but not a cause, of cold. It imparts warmth, because it can be deposited only on objects cooler than itself."

This must close, for the present, a practical man's view of the "Theory of Under-draining."

FARMYARD POULTRY:

PROFITS AND MANAGEMENT.

BY JOHN ALGERNON CLARKE.

"Birds of the courtyard," as the French call them, have acquired an important status since the days of our old agricultural authors. Thus, Richard Parkinson, in *The Experienced Farmer* (1798), says, "At the time I profess giving directions for the management of poultry, I cannot avoid hinting to the farmer that he must not rely upon the profits arising from breeding and rearing poultry for the payment of any part of his rent. I do not mean to discourage what I am fond of eating, but I should not prove myself the friend of the farmer if I did not show both sides of the question, and tell him it is possible to lose by mismanagement in this article, and scarce probable to gain, unless he selects a particular species or sort." Turkeys he condemns, as "those voracious animals, which will devour as much as any quadruped on the farm, not excepting the hogs, which can be raised at less expense. Calculate, if you can, what a turkey will cost by the time he is fit for the spit. * * Few turkeys are fit for the kitchen but what cost the farmer from 20s. to 30s., although he sells them at market for 4s. 6d. to 5s. I would advise the farmer to leave the breeding of turkeys to gentlemen of fortune. Chickens, though by many degrees not so bad as turkeys, will not pay for breeding." Geese he admits to be profitable, and adds that "ducks may be estimated on the same footing (? *web*) as geese."

In his *Treatise on Live Stock* (1810), he adheres to this unlucky view of the poor birds, saying, "Poultry will not pay (generally speaking) for what they consume, though they are convenient and pleasant, and a certain proportion ought to be raised."

Richard Kirwin, in his *New Farmers' Calendar* (1801), says, "Poultry is an article of luxury, for which the little farmer never obtains an adequate price. He had better allow his wife a certain annual sum for pin-money than suffer her to keep these devourers. An exception must be made in favor of geese, which will graze to advantage, and make much good manure; they are, besides, useful in a farmyard for giving alarm by night" (!)

George Culley, in his work *On Live Stock* (1807), gives just one half page "Of the Feathered Tribe."

Arthur Young, in his *Farmers' Calendar* (1809), owns that in some situations fowls may pay well for good food and close attention. He instances "the most successful case he ever met with:" a lady in Kent netted £20 a year by fowls, turkeys, geese, and ducks, after the family was well supplied with table birds and eggs. Her system was to let laborers on the farm raise all, at a fixed price for each grown-up bird.

London (1835) thus sums up all the information he could collect on the desirability of keeping poultry: "Though poultry form a very insignificant part of the live stock of a farm, yet they ought not to be altogether despised. In the largest farm a few domestic fowls pick up what might escape the pigs, and be lost; and on small farms, and in many cottages, the breeding and raising of early chickens and ducks, and in some situations the rearing of turkeys and geese, are found profitable." This is not very encouraging. But the Useful Knowledge Society's *British Husbandry* (1835) is a little more hopeful; devoting, however, only one page and a quarter in the two volumes to remarks on the subject. Every country housewife, the author says, knows so well how to manage, that particulars are unnecessary; and as for a history, etc., of the breeds, they doubt if the said wives would read it. They observe that the breeding of poultry could, with a little more attention, be carried to a far greater extent than at present; and they adduce the case of a Berkshire laborer, with only one room to live in, who sent up to London as many as 400 ducklings in a year, sold at six weeks' old for 12s. per couple.

Statistics of cost and profit in poultry-keeping are certainly rather scanty. As to the production of eggs, we have an experiment, given by Parkinson, of six game hens for one year, the hens being prevented from sitting. The number varied from seven to thirty-one per week, though some were laid in every month, the total being 764, or about 127 eggs for each hen. We may reckon the proceeds at 8s. to 10s. per hen. The birds were kept close in a London yard, and fed upon whole barley, of which they ate half a peck per week among the six. If the grain were worth 10d. per peck, the expense would be about 3s. 8d. per hen per annum, leaving a yearly profit of 6s 4d. per hen, without allowing anything for housing or attendance.

Mr. Punchard of Haverhill, a most successful Cochin breeder, had thirty-five Cochin hens, which laid in one year 5445 eggs, an average of 155 eggs each: there were most in January and fewest in April, the sort being especially valuable as winter layers.

Some few years ago, Mr. Mouatt, of Stoke, near Guildford, had three Polish pullets which, beginning to lay at six months old, laid in twelve months 524 eggs, or 174 each. At 9d. a dozen, this would be about 10s. 6d. per bird. During the year each consumed 5s. 4½d. worth of barley, peas, rice and meal, leaving a profit of 5s. 1½d. per bird, without reckoning anything for housing and trouble. Here we have about thirty-one eggs for each 1s. expended; and if each egg weighed one and a quarter ounces, there was produced forty-one lbs. of the most nutritious food that can possibly be procured, at the low cost of 4¾d. per lb.

There have been also a few published debtor and creditor accounts, where table fowls as well as eggs have been sold. Mr. Richard Pigott of Stokesferry gave, in the *Agricultural Gazette*, his actual expenses and receipts with ten hens and a cock in 1846, and twelve hens and a cock in 1847. All the food was bought, and the produce sold in the village,—eggs at 8d. to 9d. per dozen, chickens at 3s. to 3s. 4d. per couple. The cost of groats, oats, barley-meal, tail-wheat, eggs for sitting, and the collection of eggs was, for the first year, 8s. 9d. per bird; for the second year, 5s. 3d. per bird. The net profit the first year was 7s. per bird; the second year, 8s. per bird.

Mr. England, in a Highland Society's "Prize Essay," gave a statement of cost and produce of a poultry establishment of 100 hens. A year's expenses for food (all purchased), for house-rent, henwife, repairs, interest on building-capital, etc., averaged 10s. 6d. per bird. The returns averaged 51s. 6d. per bird, leaving a balance of profit of 41 s. per bird. This is very handsome on 100 hens; but as only 30s. are set down for the henwife, the necessary labor added would very much reduce the figure.

Mrs. Ferguson Blair, who has raised 1000 chickens a year in the Carse of Gowrie, prints in *The Henwife* her balance-sheet for 1860. Her expenses amounted to £311, 2s. 9d., and she netted only £26, 17s.; a very pitiful result for so large an outlay. The item for labor is very high, "wages £80." The food was all purchased, and very costly; and the household consumption amounted to £45, 9s. Mrs. Blair avers that she could have shown a better "credit side" if she had "gone in" for profit, and not put pro-

hibitory prices upon her show pens of poultry. Judging by the prices I have to pay great prize-winning breeders for tolerably good birds, I have no doubt that they realize a good deal of money; and, in all probability, it is the Scottish henwife's management or commercial ability that cuts so poor a figure in her balance-sheet.

There are certain great establishments in this kingdom and on the Continent, where vast numbers of hens are kept for egg-laying, being fed upon purchased horse-beef; and, undoubtedly, considerable profit is made.

But what we require are *bona fide* farmyard cases; and these are not forthcoming in connection with a well kept cash-book and ledger. In fact, however, we may just take the various foregoing profits, with considerable additions, as representing what is due from well managed poultry on a farm. Mrs. Blair says, "A farmyard is the paradise of poultry, and nowhere can they live in greater comfort and plenty. Fouls ought to pay the farmer if anybody; they have the advantage of the gleanings of the stack-yard, and at times are almost independent of any extra feeding." The truth is, that only a trifling portion of what poultry eat at a farm homestead involves any outlay, the birds picking up off the ground and redeeming from waste probably one-half of their living; while the greatest proportion of the other half consists of the tail and refuse corn, which is of only nominal value. I am speaking of course of ordinary cases, where fattening heavy and early birds is not made a regular business, to which other departments of farm management have to give place. I know, for instance, of a yard where the mistress sells over £20 worth of eggs, besides furnishing a plentiful house consumption, raising pullets for keeping up her stock of 100 hens, and feeding a few birds for her own table. The purchased food costs but a few shillings per year; the collection of eggs being the chief expense. I could name another yard where, for years, the proceeds from a brood stock of sixteen cross-bred hens with two cocks, and six ordinary brown ducks with one drake, have been over £25 per annum, in addition to the household supply of birds and eggs; no food bought excepting a few pounds' weight of chicken-rice, only a few eggs sold, and the birds disposed of at the country market-price of 2s. 6d. to 3s. 6d., and occasionally 4s. 6d. per couple. The henwife has been paid one-third of the gross receipts; but if the farmer's wife herself attended to the fowls, of course this deduction would all be saved.

Occasionally one meets with more exact details. In 1848, appeared the following statement from a farmer's wife in the north of England :—"On our farm, the poultry consist of sixty hens, principally of the Dorking breed, six ducks, and seventy to eighty geese, purchased in the autumn. A year's cost of barley, milk, meal, and corn, woman's wages, and market charges, and the geese bought in, amounted to £19, 11s. 8d. The produce—in eggs sold at 5s. 6d. per 100, and chickens at 3s. 6d. per couple, ducks at 2s. 6d. each, and geese at 5s. 6d. each—realized £54, leaving a profit of £34, 8s. 10d.

I have heard (on good authority) of a Sussex farmer who annually sends to London 100 turkeys, for which he receives £250, or 50 s. per bird! Cramming birds for the London market may be considered a business by itself. Breeding show-birds for prizes is also another occupation that only fanciers of such things will engage in. But if you "go in" for high priced pedigree stock, and manage as you should do, you will find handsome returns far beyond those for common farmyard fowls. All that I insist upon now is, that a good profit may be made by the farmer's wife when selling eggs and birds at common market prices; and though the total income from this source may be not very large, yet it is too important to be sacrificed for lack of a little wholesome interest and attention.

Fowls, like other living creatures, require a lodging. Royalty, nobility, and so on, may build palaces of stone-work, with verandas, cupolas, fancy castings, ornamental wire-work, glass, etc.; but birds, though beautiful themselves, are not gifted with æsthetic taste, and there is no need whatever for their home to be picturesque and genteel. Do not make any erection ugly, when the cost will be little more for a design that will be pleasant to the eye; but beware of building a sumptuous residence that might easily swallow up in interest all the profit you can hope to make by its inmates. The shelter adapted for a farmyard, and for a farmer who earns his living, need be only of a very simple description. Arthur Young prescribes, in his *Farmer's Calendar*, that, if a woman is kept purposely to attend to the fowls, she should have her cottage contiguous to the fowl-house, that the smoke of her chimney may play into the roosting and sitting-rooms, poultry never thriving so well as in warmth and smoke,—an observation as old as Columella, and strongly confirmed by the quantity bred in smoky cabins in Ireland. This is all very well,

barring the smoke. What we should study is a warm situation and aspect, sheltered from and shut against north and north-east winds, with no sharp draught through the house, yet with a sufficient current for ventilation; and the higher the apartment the healthier for the birds. I think a plain structure of studs and weather-boarding quite as good as a brick building, the main defect in most farmeries being the small number of separate rooms and houses. It is not sufficient to have a sitting-house, laying-house, and roosting-house for hens, a house for turkeys, another for ducks, and so on. Fowls require separation, according to sex and age, and you cannot have too many houses, boxes, and pens about your premises, in order to accommodate all. The roof should be perfectly weather-tight. The floor is not so well of brick or stone slabs as of earth, well rammed down and covered with loose gravel. This is to avoid harboring the great pests of the hen-house, fleas. Dimensions will be very much matters of fancy, but shun overcrowding. Architects often plan roosting-houses with perches one higher than another, rising like a ladder from floor to ceiling, taking care that one is not placed directly over another, as in that case the droppings of the upper row would fall upon the birds below. But all lofty perches are objectionable; heavy fowls injure their feet in jumping down; for though they will fly up or walk up a ladder to bed, they will generally take the shortest cut down in the morning. The best plan is to have perches all on a level, two to two and a half feet from the ground; the best perch being a wooden bar of three or four inches in breadth; and if supported by legs like a stool, so as to be readily moved, so much the better. Clumsy birds like Cochins prefer a roost at even lower elevation, unless a very easy ascent is prepared for them. It is not necessary to have a separate house for laying, provided the nests be at the side, far enough from the perches. But a sitting-house should be prepared, in order that the sitting hens may not be disturbed by the other fowls. I need scarcely urge the importance of cleaning out the houses, say twice a week, and of once or twice in the summer cleaning and limewashing the whole of the interior. Various notions are seen in the matter of nests. Some poultry-keepers have a number of wooden cells, like pigeon holes on a large scale, with a hinged flap or door, or a slide, in front, to fasten in unsteady sitters and to keep out intruders. The nests in my own hen-house are simply rectangular cells made of board 20 inches high, and 18 to 20 inches

long and broad, set upon the floor and close to the wall,—a bar running along the front edges of the boards, to keep the eggs from rolling out. But round shallow dishes of wicker are good; so also are shallow pans of earthenware half filled with sand; and some managers prefer simple cells of loosely laid bricks. As to the proper fibrous or other material for bottoming the nest, avoid long straw, for this is liable to pull eggs out of the nest by getting entangled about the hen's legs. Hay, again, is safer, but harbors abundance of vermin. The best materials are cocoa-nut refuse or short straw, dusted with flowers of sulphur to expel the fleas; while a sod with rough grass on it makes a good and moist foundation for all. Where you have several sorts of fowls, of course you must have a number of distinct houses, each with its small enclosed "run," or yard. Wire netting, eight feet high, will keep in most breeds, and you must have close boarding at bottom, two feet in height, to prevent the cocks pecking each other, and to keep birds of both sexes from spoiling their heads in the sharp meshes. But one of the greatest points in poultry management, even when you have only one sort, is to avoid congregating many birds in one building, or upon the same ground; neglect of this precaution often bringing disease that depopulates whole yards. If only a single farmyard is at your disposal, and your cottagers are afraid to take in young broods on account of their scratching propensities in gardens, you had better put up little houses, like enlarged dog-kennels, remote from one another, in all parts of your grounds, as spaces about plantations, shrubberies duly fenced from the flower-garden, and so on. Here place little colonies of chicks when their mother forsakes them, and you will be surprised how fast they will grow, with good feeding added to the myriads of insects and seeds which they glean from their apportioned run. People have fancies about coops and rips. My hints are, have them large enough, cheaply constructed, able to keep out the rain without requiring pieces of old sacking to be thrown over them, and closed at the ends as well as at the back. You may add a wire front, to be shut at night against weasels and rats.

You can buy some of Mr. Baily's nobby poultry fountains; but if you are not afraid of breakages, crockery ones will do. Or you may use a large flower-pot dish, with a flower-pot placed in it upside down to keep the chickens and ducks out, leaving a ring of

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water for them to dip their bills in. Fowls want also a dust bath; that is, say a box, or what is better, a glazed earthenware pan, of fine sand and wood ashes; in this the birds "rootle," dusting their plumage, and dislodging and destroying parasites. It is always well to have bricklayer's rubbish, slaked lime, burned oyster shells, coal ashes, and gravel lying about a poultry-yard; besides being sweetening and sanitary, they afford the birds pieces of hard material, as fine stones and bits of mortar, so indispensable for the milling action of the gizzard.

I come now to the general management of fowls. When you keep hens for their eggs only, the proportion of hens to one cock is immaterial, infertile eggs being as good as others for the egg cup and for cookery. It is best, however, to let twenty or thirty hens follow a champion and protector, who takes care of them, finds food for them, and often, with true gentility, sees that all are supplied with pickings and scratchings before partaking of anything himself. For breeding strong, healthy chickens, give only six or eight hens to one cock, though a young bird may have ten. The old-fashioned plan is to breed in-and-in from the strongest "cockerels" (that is, cocks in their first breeding year after arriving at the adult age of six months); rarely introducing a purchased bird for "change of blood." But prize-poultry men know very well that a dwindling progeny is a sure result of breeding from closely related fowls, while there is no more common cause of disease. A cock will work well for a couple of years; if he be a favorite you may keep him three years, if the young birds do not "whip" him and wear out his life. My practice is to keep sixteen females in a farmyard with a second-season cock (or "stag") and a young cockerel for his first season; this difference of age insuring the mastery to one of the warriors, and so preventing repeated and desperate duels. It would be far better to place the two cocks, with eight hens each, in separate yards—so avoiding innumerable bad eggs. A pullet hatched early in spring begins to lay at the approach of winter, and pullets hatched late in summer begin to lay in the ensuing spring; and it is by saving a certain proportion of pullets from the early and late broods that you make sure of winter eggs, a few very early-hatched chickens for catching the highest markets, and a numerous flock of chicks throughout the warm months when rearing is least precarious. The hen continues in her prime for two and, at most, three years; therefore, save every year pullets equal to say a third of your brood

stock, selling off at a trifling price the same number of aged hens, or offering them up in a stewed dish or well-baked pie. However, I make no scruple about keeping a heavy, symmetrically-made, splendidly-feathered "partlet" for four years, for the sake of her stock. Many farmers grumble about their poultry, from not paying attention to such a simple matter as looking over their brood stock once a year, drafting all the old dames, known by the developed scales upon their legs, and reserving from the market-basket the most promising young pullets raised during the season.

In a general way, it is not worth a farmer's while to try for very early chickens. For midsummer-show purposes, and in the neighborhood of large cities, where 10s. or 12s. or more per couple can be obtained for extremely forward birds, it may pay well, but the labor and trouble demand great perseverance. A pullet saved from an early "clutch" will lay in December, and hatch in January or early in February; but she must sit on only seven to nine eggs, and if she hatches half-a-dozen chicks, you may consider it very good luck for that cold season. The clutch must be shut in a warm room, with dry earth, gravel, or ashes to run on, as a stone or brick floor will cramp the chickens' legs almost as surely as wet earth or grass. The nights are so long that the time between one day-light feed and the next would be starvation to the tender little creatures; so that you have to feed by candle-light (without ever omitting) late at night and early in the morning, laying the food upon a black-painted board, and shining the light upon it while the chicks are pecking. March, April, and May hatching is a much easier matter, and the second brood (for a good sitting breed hatches twice, sometimes thrice, in a year) will come in July, August, and September. Late hatches should be avoided.

As laying-time comes on with the opening year, when the combs of the pullets begin to redden and their bodies enlarge, be diligent and liberal with your feeding; more particularly because frost and snow often deprive the birds of their "shack," and insects, worms, etc., being scarce, animal diet should be provided in their place. Of course, grain is the staple food,—as whole corn, with tail wheat that usually has much "split" among it, and a proportion of bruised oats. Mashed potatoes, "cree'd" rice, soaked bread, garden vegetables, make good changes in the diet; and paste of barley-meal or oatmeal, etc., is advisable for getting up and preserving "condition." To promote laying, give the hens the bones

and scraps of meat and fat from the dinner-table; indeed, waste nothing eatable out of the kitchen and pantry, and do not scruple to rob the pig-wash tub in favor of your fowls. A capital addition is a quarter of a pound of horse beef among half a dozen hens, given three times a week. And bullock's liver, and again sheeps' entrails, boiled, chopped, and peppered, are supplied with excellent effect. Keep to regular feeding hours, twice a day being sufficient, but three times all the better (I am speaking now of adult fowls), and scatter no more food than the birds will eagerly and quickly devour. Extravagance leaves half the provender to be gleaned up by flocks of sparrows, and makes poultry-keeping expensive.

Look up eggs daily, or oftener if you please, for fear of thieves, or of frost in its season; of course leaving the necessary nest-egg. And you may use pieces of chalk, porcelain eggs, or eggs turned in wood and painted white, to entice the hen to her nest. One of the annoyances of fowl-keeping is being deceived by your eggs, having to throw them away rotten from under the patiently sitting hen. Perhaps you cannot always guard against this evil. For the sitting-house may be warm enough, the nest not too dry, the eggs well preserved and not too old, and yet failure ensue. In fact, cold weather will sometimes conspire against your management, and eggs will be infertile in spite of your proper mating of the sexes, your careful treatment of the eggs, and your good feeding of the sitting hen to keep up the warmth of her body. But at any rate adopt every known precaution. Avoid shaking the eggs when selecting them; place them in boxes in preference to drawers, which shake all your eggs every time they are opened and shut. The slightest touch of frost is fatal; so place the eggs in bran or chaff, laying them on their side, and turning them once every day; because the hen almost always brings off a full clutch when she has "stolen" her nest in some secret retirement, and her eggs are laid on their side and turned about by her getting on and off her nest. A good plan is to pencil-mark the day of the month on the side of each egg when you put it by, then you turn the marks down one day, and up again the next; and you can see the age of every egg you select for sitting. The fresher the egg. the better; still you must always have a sufficient number in reserve, lest several hens should want to sit at one and the same time. Eggs for consumption may be packed in bran or in salt, or kept in lime water, for almost any length of time, placed with the

small end downwards. Of course the parentage of an egg is the main point in determining the probable character and quality of the bird; but the size and shape are of some importance. Small rounded eggs, laid by pullets, may bring fine birds; but their earliest eggs are not worth setting. Choose an egg of medium size (an extremely large one may contain two yolks and prove an abortion), well formed, without any rib or flaw, and with the air-vessel distinctly marked at the top of the egg when this is held end upwards between the eye and a candle. Some persons pretend that the air-vessel when in the centre foretells a cock, while towards the side it betokens a pullet.

When a hen is "broody" or inclined to sit, she clucks, as if calling chickens—which, perhaps, she sees in imagination; and a young pullet had better be proved with an egg or two whether she is a steady sitter, lest a seat of valuable eggs should be spoiled by her forsaking them; though eggs are not always ruined by getting cold after a few days' sitting. Cruel means are sometimes resorted to for making a hen sit when she is not disposed, and still more unfeeling practices are adopted to prevent a hen sitting when she is wanted only for egg-laying. But I strongly condemn all attempts at confining a poor bird, and making a mother of her against her will; while the prevention of sitting is easily accomplished (in case a seat of eggs turns out rotten and the hen persists in her expectation of chicks), by continually disturbing the hen, shutting her up where she can find no eggs, and by cooling her incubation fever with a cold-water bath. To make a hen sit in the place you choose for her, you have only to take her from her stolen nest at night, and cover her over for a time. Re-line a nest before setting a hen, sprinkling a little sulphur to banish fleas as much as possible; and it is well to barricade her at first against being disturbed by other birds. The proper number of eggs in spring and summer will depend upon their size and upon the size of the hen, ranging from eleven to sixteen, or even more. The hen will commonly leave her nest every day for food and water; but if you have boxed her in, you must take her off once a day, and bear in mind that, as she has now no exercise to aid digestion, the food should consist of a little hard, but principally of soft, substance, as oatmeal or barley-meal paste, chopped cabbage, lettuce, and so on. If you find later eggs in the nest, remove these unmarked eggs, seeing that they would not hatch simultaneously with the others; this point, however, requiring

most attention when you have cross-bred hens among others of some valuable breed. Book the date of each setting, and on the ninth or tenth day examine the eggs (in Lincolnshire we call it "shiring"), by holding them between your eye and a beam of light,—as a candle in a darkened room. If an egg is right it will appear quite dark, except a small clear disc at the top; if the egg appear semi-transparent throughout, it should be taken away, as it is infertile, would probably become rotten, and yet, at this stage of the proceedings, makes a good dinner, boiled hard and chopped up, for a brood of chickens. The hen sits twenty-one days, generally sitting very closely during the last week; but if through any accident the eggs are left to get cold (in that week), the birds may sometimes be hatched by another hen, or by artificial warmth. To avoid the common disappointment of chicks dead in the shell, damp the eggs daily during the last week, either dipping each egg in lukewarm water, or sprinkling a little cold water on the eggs from a brush. Moistening the porous shells prevents the living membrane from becoming so hard and dry that the poor little chick cannot break through it; and you need not be afraid of the operation, as a hen generally damps her eggs in a stolen nest from getting her feathers trailed in wet or dewy grass and herbage. Look frequently at a hen as her term draws to an end—taking away any rotten eggs which might explode and kill a half-hatched chicken; and remove the earliest chickens to prevent the mother running off with them and leaving the rest to die in the shells. Young managers are wont to feed their new-born treasures too soon, as if fancying that the little prisoners must be hungry, because they had nothing to eat all the time they lay doubled up in their shells. But the rule is,—no food of any kind for twelve hours; all they want is heat. Beware here of old wives' nostrums. If a baby is born, it must at once learn that it has entered into a world of drugs, by swallowing a dose of castor-oil, just "to clear its little stomach." If a cow calves, she cannot prosper until she has eaten the placenta; and a chicken must not only have the nib taken off its beak, and the beak dipped in water (which is all right enough), but must have a nasty, hard, black pepper-corn forced down its throat—I suppose to be conducive to its misery and destruction, by at once irritating and weakening the digestive organs. Give the chicks plenty of bread soaked in milk, a few bread-crumbs, and roughly ground wheat-meal, wetted with luke-

warm milk (skim-milk will do), of such a consistence that when a little ball or pellet of it is thrown upon the ground it will break and scatter about in particles. After a few days vary the diet with cheap chicken-rice, cree'd soft, and a scanty allowance of whole corn, which should be the fine, small screenings of wheat. Vegetables—as cabbage and onion tops chopped fine—make a nice admixture with other food (potato, however, is too scouring); and every other day you may give each clutch a hard-boiled egg, or a little mutton suet, chopped fine. In fact, study frequent changes of diet. For the first fortnight chickens need almost hourly feeding. If they have a good "run" among grass and shrubs in warm, dry weather, thus picking up abundance of insects, they will want proportionately less food; but never offer them more than they eagerly run after. Both hen and chickens must have clean, often-renewed water within reach, arranged so that the chickens cannot get their legs in, and so that the hen cannot upset it. Let the coop be daily moved to a fresh patch of ground. In warm weather, the hen, after the first week, may be let out during the day, provided she be "a good mother;" for some wild and tiresome hens will trail their little ones to death, over-walking the poor little things, and at least hindering their growth. In cold or wet weather coop close, and place the clutch in a house at night. The length of time for cooping (say two to four weeks) depends upon the weather, the vigor of the chickens, and the quiet or straying habits of the mother—some hens being awkward in a coop, trampling very young chicks to death, and so requiring plenty of room or earlier liberty. When two hens come off at the same time, let one take both broods, if in summer, that the other may lay again the sooner; but in cold weather, one small clutch is plenty for one mother to cover and find food for.

A common error is to coop successive broods in the same small enclosure, probably because this is near to the kitchen door, and convenient for the constant attention which is required. But separation is a main point in rearing healthy birds. Distribute your coops about your yards, of course choosing safe and sunny places; and if your early broods occupy a space before your house, you may put the latter broods on a plot behind, and so on, always allowing a considerable interval to elapse before following upon the same ground, to avoid getting the walk "tainted," as it is termed, with liability to disease.

It is a modern practice to separate the sexes at two months old, or earlier, sending the cockerels to a yard by themselves, as they are found to thrive better, and live together without quarrelling. And here comes in the advantage of having several yards, at considerable distances apart; in fact, separate poultry establishments upon the same farm, which may often be contrived in connexion with bailiffs' or laborers' cottages.

A well-fed fowl taken from the strawyard is very nice eating; but beyond this, you may have a very heavy and thoroughly fat, as well as delicately-flavored fowl. This is when they have been "put up" to feed. At three or four months old, younger in summer, and older in winter, shut the fowls in a confined space, as a coop or hutch, giving the birds room to sit or stand, but permitting them to turn round and move about only with difficulty; the bottom being made of longitudinal round bars, on which the fowls perch, and between which their droppings fall. This coop must be under cover, and in a warm and rather dark place. A V-shaped trough of wood, or better of earthenware or glass, is placed along the front of the coop, receiving three times a day as much food as the birds will eat at once, and being immediately afterwards cleared out. Mr. Baily prescribes oatmeal and milk, mixed slack, but not quite liquid, the consistence being such that if some of it is placed on a board it will slightly spread. Fresh water should be accessible in pans, and a little gravel given occasionally. It is indispensable to feed at sunrise, the birds make no progress if suffered to get hungry. Their term of confinement should be a fortnight, or rather less, if they were in good condition when put up, and if they have been kept quiet, without any introduction of a strange or a quarrelsome companion. It is not often that the birds will preserve their health for three weeks of such treatment.

Cramming is not a refined practice, but as money is made at it, and the punishment to the fowl is not worthy of mention in comparison with the horrors of caponizing, I must describe it. The oatmeal is mixed considerably stiffer than as last mentioned, and the milk, of which it is made, may have a little mutton-suet boiled in it. The paste is formed into "crams," rolled up dry, each as thick as a little finger, and nearly a couple of inches long. Six or eight of these elongated boluses are administered morning and evening, being dipped in milk or pot-liquor, to make them go down "slick" and easy. Mr. Baily's description of cramming is as follows:—"The fowl is placed in the lap, the head is held up, and

the beak being held open with the thumb and finger, a cram is introduced into the gullet; the beak is then closed, and the cram is gently assisted down till it reaches the crop; care must be taken not to pinch the throat, as ulceration would follow, and the fowl would be spoiled." Water and gravel should be provided for the birds to help themselves; and, if they seem to require it, a little food may be placed before them at mid-day. "Before the second feed is given, the crop should be lightly felt to ascertain if it is empty. If not, the morning meal has not been digested; the fowl must be taken out immediately, and the beak being held open, as if for cramming, some warm water or gruel should be poured down the throat, and the beak closed. This will soften the food, but if more food were forced into the crop on that already hardening there, the bird would become crop-bound, *i. e.*, the food would become solid and indigestible, and the fowl would be totally spoiled for the table, if it did not die." A machine, on the principle of a force-pump, has been employed, by which one person can cram a dozen birds in seven or eight minutes.

You judge the fatness of a fowl by feeling if the breast is plump. The skin under the body should also be thick and fat, and fat may also be felt under the wings. Cadgers in the poultry markets are accustomed to nip the rump laterally with the finger and thumb; it should be thick, fat, and firm.

When you have successfully bred, reared, and fattened a prime young fowl that is to be a delicate dish on your table, it is very disappointing to have all your pains nullified by the indiscretion of a cook. Tenderness is a quality that can be secured by keeping the bird long enough between the slaughtering and the spit; and to make it keep well for a couple of days in summer, or much longer in cool weather, fast the fowl twelve hours before bringing him to the knife.

On the subject of diseases I shall add little. Poultry books are generally half full of diagnosis and remedies; but in few farmyards is a troublesome manipulation of cocks and hens, or an elaborate preparation of pills and drinks, likely to be followed up. A great deal of quackery, as well as a great deal of learning, has been printed on this subject. You can consult some of the valuable handy-books which great authorities have published; and all I can do in this brief lecture is to point out a few of the commonest ailments, with the most effectual mode of treatment. For diarrhœa, mix cayenne pepper and chalk in gruel, or with meal. If a

purgative is required, give a teaspoonful of castor-oil, or a little jalap made into a pill with butter. For indigestion, when a chicken is suddenly taken with a convulsive fit, the legs straightening out, and the crop hard, pour warm water down the throat, and next day feed on soft food. For mange, or loss of feathers, scarring of the comb, etc., give small quantities of sulphur and nitre, mixed with butter. When birds suffer too much, and are long "on the moult," try a little extra stimulating diet, as hemp-seed, buckwheat, animal food, and that great restorative, bread soaked in ale. When chickens get the pip, gaping, with a horny excresence on the tongue, tear off the hard substance with your thumb-nail, administer pills of rue and bread, or made of scraped horse-radish and garlic, with a grain of cayenne pepper, and supply plenty of clean water. Roup is a very dangerous and infectious malady—a very plague among fowls. The premonitory symptom is, that the skin hanging from the lower beak, and to which the wattle is attached, is inflated and emptied at every breath, the same hoarseness and difficult breathing as if from a cold. Give a table-spoonful of castor-oil, and a few hours after, one of Baily's valuable "Roup and Condition Pills." If there be rattling in the throat, with a fœtid discharge from eyes and nostrils, wash the eyes, nostrils, and inside of the mouth with vinegar. Mrs. Ferguson Blair gives this prescription:—"Take of dried sulphate of iron, in powder, half a drachm; capsicum, in powder, one drachm; extract of liquorice, a sufficient quantity to make a mass, which is to be divided into thirty pills. One to be given three times a day, continued to the end of the third day, and then followed by a second prescription. This is, half an ounce of sulphate of iron, and one ounce of cayenne pepper, in fine powder; mix carefully a teaspoonful of these powders with butter, and divide into ten equal parts—one to be given twice a day." Gapes, is another common disease, arising from small white worms in the trachea. Grain, wetted with spirits of turpentine, is one medicine; camphor, in the drinking water is another; but a complete means of cure is of a surgical kind. Take a hen's tail-feather, stripped all but an inch at the end, put it down the bird's windpipe (not the gullet), twist it once or twice round, and withdraw it with the worms adhering. This is an operation, however, "more easily said than done."

A descriptive and historic account of the various popular breeds, with the special purpose for which each may be valuable, does not

come within the present lecture; and I now proceed to offer a few hints about other poultry beside fowls.

Ducks, clever as they are at taking care of themselves, are somewhat difficult to manage, as far as "good luck" with sittings is concerned. The wild duck being monogamous, shows that only a few ducks should be allotted to one drake, say five, or at most six; four would be all the better. As the treading generally takes place upon the water, the duck diving at the time, the birds must always have free access to their favorite element, not necessarily in a pond, for a tub a foot and a half deep will suffice. And as they are of very early habits, you must either provide a tub of water in their house, or else let them out very early in the morning. Certainly there are few districts where it is safe to leave ducks out in a yard, or wandering "worming" about the pastures all night. *Apropos* of the tub, bear in mind that a duck *can* be drowned as readily as any other animal; for if too long in the water, with the feathers saturated, the poor bird will sink; therefore, form your tub so that the ducks can easily get out. Ducks are wonderfully fastidious about their nests. In frosty weather you must take away the eggs; and as the duck will lay thirty or forty eggs, you can hatch them under hens, which, indeed, make by far the better nurses. March is early, April a better month for ducklings to come off, as they like warmth no less than water. The duck must be closely cooped for the first week, or she will soon tire out and so kill her young; she must be apart from any other duck, to prevent the little ones going to the wrong coop, and being seized by the wrong mother's sharp bill; and she must be away from pond or stream, lest the ducklings should get their legs cramped with the cold. Let the duck have a saucer or dish to drink from; and let the ducklings paddle in a shallow tray, placed a yard or two from the coop, to prevent accidental slopping and soaking of the tender little birds. In very dry warm weather this discipline need not last more than a few days; then move the duck and coop to the margin of a pond (still apart from other ducks, as some ducks, and drakes too, are very vicious, and are apt to kill off a whole brood in a few minutes); and when the ducklings are a fortnight old, they may be separated from their mother, driven to the water in the morning, and shut up in a house at night. Beware of having deep pans or buckets of water where ducklings and chickens can have access to them; keep none but very shallow drinking vessels for your poultry; empty your stable

buckets when not in use, and float pieces of board in your horse and cattle water-troughs. The first food for ducklings is bread soaked in milk, or paste made of barley-meal and new milk; malt flour is also used as more fattening. You may give also boiled rice and potatoes, and small wheat soaked, with frequent treats in the way of flesh. But with muddy ponds to luxuriate in, they need little else than an opportunity of filling their crops with meal paste.

Turkeys require very great care and attention; yet where the henwife makes them her pets, and studies their welfare in every way, she at any rate (whatever the farmer himself may say), may find them profitable. The turkey hen lays one egg about every thirty hours, and should be set upon a dozen eggs and fed with corn and water. She sits a month. When the chicks come off,—taken one by one as they escape out of the shells, and wrapped in flannel,—they are commonly made to swallow a pepper-corn each, as well as to drink a little water; they need no food for twenty-four hours, and will then pick what is placed before them. Their food should be hard-boiled eggs chopped very fine, or curd with bread crumbs, and boiled nettles, and green onions finely minced. Coop the hen for a fortnight, and then let her ramble with her young, being warmly housed at night, but beware of the least wetting by rain. A critical time with them is at a little over two months old, when the male and female markings begin to appear, and the birds are called turkey "poults." Boiled vegetables, meal, grain, and various seeds are employed in feeding them; after harvest they will range the stubbles, and many henwives "top up" their favorites by cramming for Christmas markets.

I conclude this imperfect lecture with two or three hints on the management of geese.

A gander should be mated with three geese; certainly not more than four, and perhaps two would be a luckier number. In her first breeding season the goose has few goslings, but after that remains in her prime for years. She lays twelve to twenty eggs, but with high feeding will sometimes lay thirty or even forty. You should get two hatches in a year. In the middle of February the goose is commonly inclined to lay, and evinces her condition by running about with straws in her mouth, as if nesting. Watch her, and when she drops an egg, take the goose and the egg and fasten her for a while upon the place you have prepared for her laying and sitting. A few boarden boxes, with straw-thatched

top, answer very well for geese, and are best placed beside a pond, and in a sheltered situation. She may sit upon from ten to fifteen eggs, according as she is a young or old bird. Her time of incubation is one month, and a little aid in breaking the shells is sometimes necessary, but beware of making the partially-spretched gosling bleed. If one goose comes off just about the time another is due, fasten the latter on her nest, to prevent her perhaps leaving her eggs to spoil upon hearing the "croodling" cry of her neighbor's young ones. The goslings want no food for twelve hours, then give bread soaked in milk, porridge, curd, greens, chopped cabbage, bran mixed with boiled potatoes, etc., and provide a sod of grass for the little bills to pull at, with plenty of water for them to drink. Keep them out of the water for a few days, sunshine being their best food, and rain their fatal enemy. Shut them up for some days, and when they go out watch them in windy weather, as a gosling blown upon its back cannot get on its legs again, and will die.

Grass and herbage are the main food of geese, but fatten them upon oats and meal.

A goose put up to fatten eats a pound of oats daily for the first week, and three-quarters of a pound daily afterwards; a goose in good condition off stubbles being fattened on oats and water in three weeks.

When a goose's feathers are "ripe" they should be plucked off, an operation that gives little pain to the bird if properly performed, and at the right time. The feathers under the wing are always left to hold up the wings, which would otherwise trail upon the ground. It is usual to pluck three times in the season, one goose yielding a pound of feathers in the three pluckings.

In some well-watered districts geese are profitable, and in a very growing season they do little damage to the pastures. In dry summers, however, they are very injurious; pulling up much good herbage by the roots, and, what is worse, in badly watered localities, fouling and spoiling the ponds for horses and cattle.

In conclusion, I would say that a short lecture must not be taken for an elaborate handbook; though I trust you will find in it some useful hints for your guidance.

LONG SUTTON, Lincolnshire, June, 1865.

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